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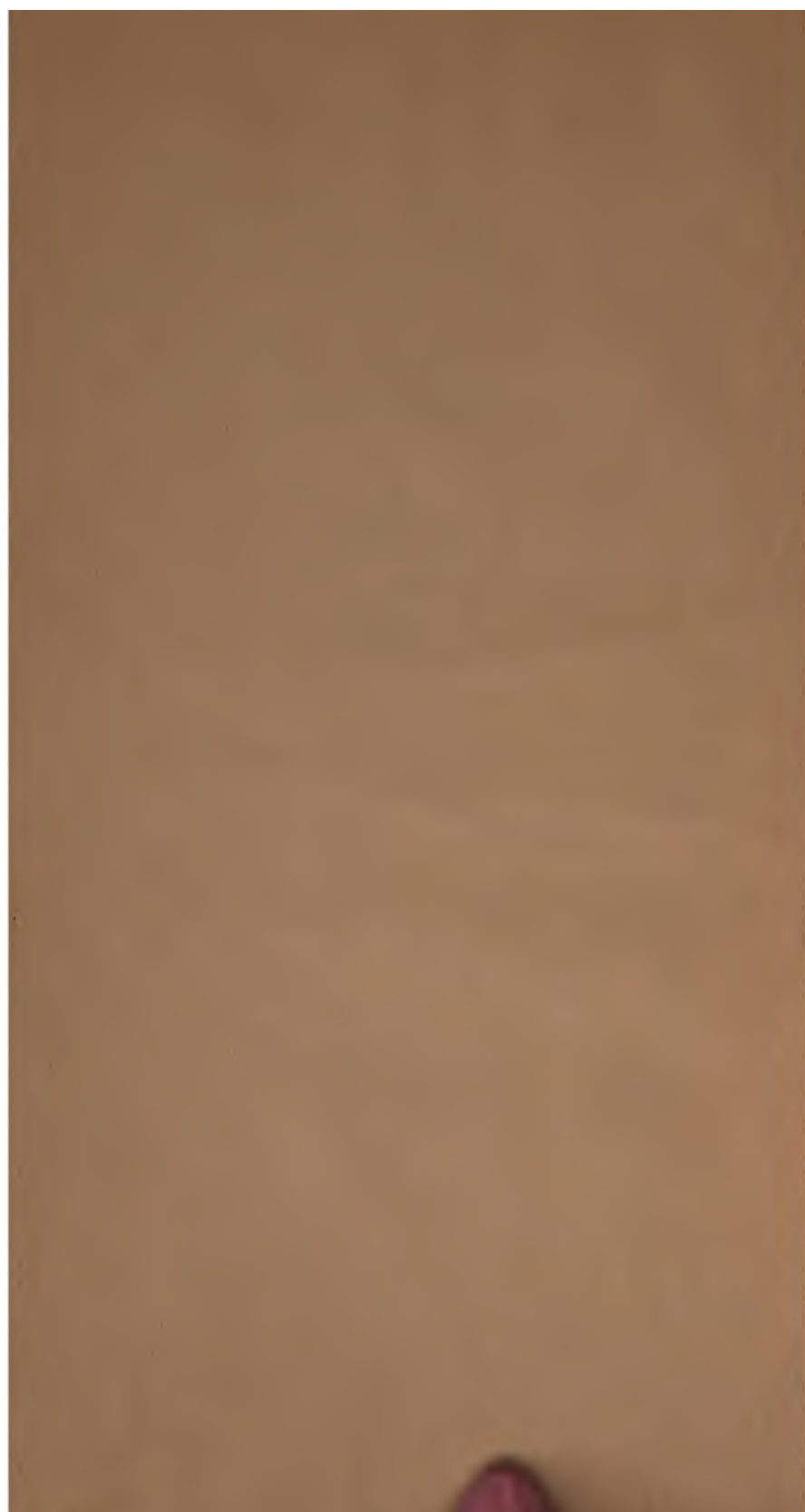


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HISTORICAL SKETCH

OF THE

MIDDLESEX CANAL,

WITH REMARKS

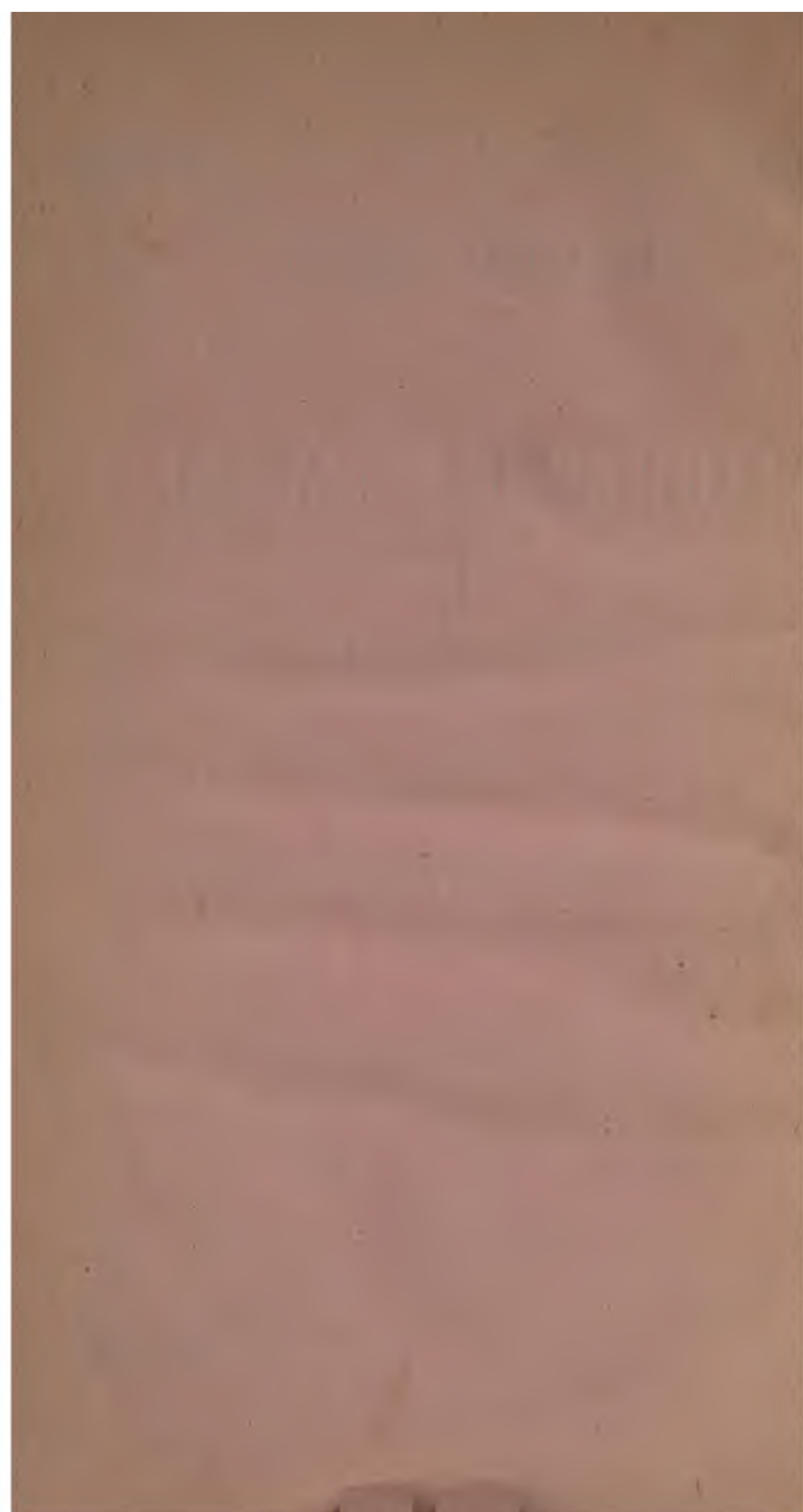
FOR THE

CONSIDERATION OF THE PROPRIETORS.

BY THE AGENT OF THE CORPORATION.

Caleb Bddy.

BOSTON:
SAMUEL N. DICKINSON, PRINTER.
1843.



HISTORICAL SKETCH
OF THE
MIDDLESEX CANAL,
WITH REMARKS
FOR THE
CONSIDERATION OF THE PROPRIETORS.

BY THE AGENT OF THE CORPORATION.

Calcutt & Co.

BOSTON:
SAMUEL N. DICKINSON, PRINTER.
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MIDDLESEX CANAL.

In the month of May, 1793, a certain number of gentlemen associated 'for opening a canal from the waters of the Merrimac, by Concord river, or in some other way, through the waters of Mystic river to the town of Boston.' There were present, at this meeting, the Hon. James Sullivan, Benjamin Hall, Willis Hall, Ebenezer Hall, Jonathan Porter, Loammi Baldwin, Ebenezer Hall, Jr., Andrew Hall, and Samuel Swan, Esq.

After organizing, by the choice of Benjamin Hall as chairman, and Samuel Swan as clerk, 'the Hon James Sullivan, Loammi Baldwin, and Captain Ebenezer Hall, were chosen a committee to attend the General Court, in order to obtain an Act of Incorporation, with suitable powers relating to the premises.' In conformity with this vote, a petition was presented to the General Court, and a charter obtained, ('incorporating James Sullivan, Esq. and others by the name of the Proprietors of the Middlesex Canal,') bearing date June 22, 1793; and on the same day was signed by his Excellency John Hancock, governor of the Commonwealth.

By this charter the proprietors were authorized to lay assessments, from time to time, as might be required for the construction of said canal. At the first meeting of the proprietors, after the choice of James Sullivan as moderator, and Samuel Swan as clerk, the following votes were passed, viz., 'That the Hon. James Sullivan, Hon. James Winthrop, and Christopher Gore, Esq. be a committee to arrange the business of the meeting, which they reported in the following order.

'*Voted*, That the business of the corporation be transacted by a committee annually elected, consisting of thirteen directors, who shall choose their President and Vice-President out of their own number.

'*Voted*, That the Hon. James Sullivan, Loammi Baldwin, Esq., the Hon. Thomas Russell, Hon. James Winthrop, Christopher

Gore, Esq., Joseph Barrell, Esq., Andrew Cragie, Esq., Hon. John Brooks, Capt. Ebenezer Hall, Jonathan Porter, Esq., Ebenezer Storer, Esq., Caleb Swan, and Samuel Jaques, be Directors for pursuing the business of the canal for the present year.

At a meeting of the Directors, October 11, the following vote was passed:

Voted, That the Hon. James Sullivan be President, Loammi Baldwin, Esq., First Vice-President, and Hon. John Brooks, Second Vice-President.

The Board of Directors being duly organized, the next duty was to commence 'the necessary surveys of the most eligible route between Medford river and Chelmsford, by the Concord river.' Here the committee were met by an almost insurmountable difficulty; the science of Civil Engineering was almost unknown to any one in this part of the country. They were, however, determined to persevere, and appointed Mr. Samuel Thompson, of Woburn; who began his work and proceeded from Medford river, at a place near the location of the present lock, and followed up the river to Mystic pond, through the pond and Symmes's river, to Horn pond in Woburn, and through said pond to the head thereof. Meeting here bars they could neither let down, nor remove, they went back to Richardson's mill, on Symmes's river, and passed up the valley through the east part of Woburn to Wilmington, and found an easy and very regular ascent until they reached Concord river; a distance travelled, as the surveyor says, 'from Medford bridge to the Billerica bridge, about twenty-three miles, and the ascent he found to be, from Medford river to the Concord, sixty-eight and one half feet.' The actual elevation, when afterwards surveyed by a practical engineer, was found to be *one hundred and four feet*. By the original survey from Billerica to Chelmsford, the surveyor says, 'The water we estimate in the Merrimac at sixteen and one half feet above that at Billerica bridge, and the distance six miles,' when in fact the water at Billerica bridge is about *twenty-five* feet above the Merrimac at Chelmsford. This Report shows one of the many difficulties the Directors had to contend with for the want of requisite scientific knowledge.

On the first day of March the Directors passed a vote appointing Loammi Baldwin, Esq. to 'repair to Philadelphia and endeavor to obtain Mr. Weston's (an English engineer,) assistance in conducting the canal. If he cannot come, then that he endeavor to obtain some other person who shall be recommended by Mr. Weston, and that said agent be authorized to write to Europe for some suitable person for the undertaking, if none can

be found elsewhere.' Col. Baldwin made a lengthy and able report, on the twelfth day of May, 1794. Among other things he says, he has engaged Mr. Weston to make the survey of the route in the month of June, and closes his report as follows: 'I consider the prospects before us in this undertaking much more flattering in respect to the execution of the work, in proportion to the extent, than any I have seen in the Southern States; the Washington canal excepted.' About the fifteenth of July, Mr. Weston arrived, and a committee, consisting of Loammi Baldwin and Samuel Jaques, was appointed, 'to attend him during his survey and observations relating to the canal.' The survey was completed, and a full report made, by Mr. Weston, on the second day of August, 1794. Agents were immediately appointed to carry on the work, to commence at Billerica mills, on Concord river, and first complete the level to the Merrimac, at North Chelmsford. The season having so far advanced, but little could be done, until the next spring, except purchasing materials and making contracts for future operations. The work was prosecuted with great caution, from the commencement to the year 1803, at which time it was so far completed as to be navigable from the Merrimac to Charles river; but delays and great expense were incurred, for many years, owing to imperfections in the banks, and other parts of the work; and about the whole income was expended in additions, alterations, and repairs, and no dividend could be or was declared until *February the first, eighteen hundred and nineteen.*

The charter allowed assessments to be laid, from time to time, until the works should be completed, and all the debts of the corporation fully and justly paid. One hundred assessments were laid; the first on the first day of January, 1794, the last on the first day of September, 1817; amounting, with interest added to February 1, 1819, (the date of first dividend,) to *fourteen hundred and fifty-five dollars and twenty-five cents on each share*; making the whole cost of the canal *eleven hundred and sixty-four thousand, two hundred dollars.* There have been paid, in dividends, from the year 1819 to the present year (1843) *five hundred and four dollars* on each share, (averaging \$20.16 per ann.) an interest on the cost, of about *one and thirty-nine one-hundredths* of one per cent. per annum. From the year 1819 to the time the Lowell Rail-Road went into operation, the receipts regularly increased, so that the dividends arose from ten to thirty dollars per share; and no doubt in a few years, without competition, they would have given a handsome interest on the original cost. The year that road went into full operation, the receipts of the canal were reduced *one third*; when

the Nashua and Lowell road went into operation they were reduced another third. Those of the last year, and the present, will not be sufficient to cover the expenditures for repairs, and current expenses. The future has but a gloomy prospect. For the past twenty years, and during the time I have had the management of the canal, I can truly say, the directors have spared no pains or expense, in keeping it in perfect order for use; and the public have derived great advantage from this water communication, in the transportation of timber, (for ship-building,) and other heavy lumber, as well as wood and merchandise generally. The inventions and ingenuity of man are ever onward, and a new, cheap, and more expeditious mode of transportation by steam power has been devised, which seems destined to destroy that which was once considered invulnerable. What is to be done? Improvements in mechanics and the arts will go on, while man has mind; if the canal cannot put out the fire of the locomotive, it may be made to stop the ravages of that element in the city of Boston, should the proprietors, after mature consideration, deem it for their interest so to devote it. The canal was brought into existence by the aid and assistance of the Legislature; and by their power it has received a hard blow. There is yet vitality, and the same power that created and has nearly destroyed it, can resuscitate and give to it a valuable existence for the future. I trust, upon a respectful and proper representation of the condition of your interests, as they exist at the present time, and the past great exertions of the proprietors to serve the public faithfully, together with the immense sacrifices that have been made, the legislature will be disposed to view the case as one of equity, and render every aid in their power to preserve and make it more valuable than heretofore. I know of but one way in which the canal can be of much value to the public, and those who now hold an interest therein, viz. by changing a part of it from one public use to another. Discontinue the levels from the Charles river to Woburn upper locks, and from Billerica mills to the Merrimac river, in the whole, a distance of over fourteen miles. The remaining part from the Concord river to Woburn upper locks may then be used as an aqueduct, similar to those in France and other European countries. From Woburn, the water may be conveyed in thirty inch iron pipes, for the supply of the city of Boston, the towns of Charlestown, and East Cambridge. I have made calculations of the quantity of water that will be saved (by the discontinuance of fourteen miles of canal) from evaporation, filtration, and lockage, and likewise estimates of the cost of laying the main pipes to the city, with suitable reservoirs, and on the

distribution in the city; all of which I hereby submit for the consideration of the Proprietors and Directors. I have likewise caused surveys and plans to be made, showing the whole route of canal, and the elevations of the same from Charlestown to the Concord river, at Billerica. I have had the water analyzed at different seasons of the year, by four of the most distinguished and able chemists in the country, all of whom agree that it is in every respect of the requisite purity for drinking and for culinary and all other purposes. (See *Appendix*.)

I shall now submit the calculations in regard to the saving of water, effected by discontinuing the proposed levels; and afterwards the estimates for constructions necessary for supplying the city of Boston with good soft water, for any and all purposes for which it may be required.

The quantity of water lost by evaporation and filtration from a canal, of the size of the Middlesex, according to the usual estimates of engineers, (See Potts on Canal Cutting,) would be Fifty cubic feet per mile per minute.

This on fourteen miles would be equal to	7.560.000	galls.	per day
The locks at Chelmsford have been filled and discharged (by a correct account kept by the lock tender) on an average over 6000 times a year. Loss by lockage, say	1.000.000	"	"
Ditto at Charlestown,	1.400.000	"	"
Ditto at Medford,	1.000.000	"	"
	<hr/> 10.960.000 gallons.		

In addition to the above, a vast quantity passes over the waste wiers, the escape of which is unavoidable, particularly in the hot and dry seasons of the year. The lock tender, at the lower end of each level, is obliged to draw from such level in order to keep up the level below him. This draws down the first level at the lower end thereof; consequently, the lock tender next above, on the line of the canal, has to drive on all the water the canal banks will sustain, in order to keep up the lower end of the level below him. The water in its progress meets the contracted places at the bridges, which for a time backen it, and the waste wiers serve as safety valves to prevent the overflowing or breaking the banks of the canal. The waste wiers are indispensable for keeping up the levels to a uniform height. In order to arrive at an estimate of the average quantity of water con-

sumed per day in the working of the canal, or to as near an approximation to accuracy as the present state of the subject demands, inquiries have been made of some of the most experienced lock tenders as to what in their opinion, and according to their best judgment, would be the section of orifice of discharge and head of water over the same, at their respective locks, necessary for an average supply of the canal below them. Calculations, made on their statements, prove that about 2,000,000 gallons, per mile, per day, must be used; so that by excluding the water from the levels, south of the upper lock at Woburn, and north of the Concord river, say fourteen miles, about 28,000,000 imperial gallons would be saved. In case of the change proposed, viz. that of using the canal as an aqueduct for the supply of water to the city of Boston, the great quantity thereof, now unavoidably wasted, would be saved; as the levels might be reduced six or eight inches from their present elevation, in which case there would be no further necessity for the wiers. The water would pass on from one level to another, in just the quantity required, for the supply of the iron pipes at Woburn, and by them would continue (without loss or waste either by evaporation or filtration) to the reservoir near Boston. The volume of the said water, in all probability, would never exceed one half of that now used for canal purposes. The canal mills, and those below them, on the Concord river, would receive an increased quantity of water. There might be still another advantage by the proposed change. The flash-boards are ten inches in height, above the stone dam at Billerica mills. In case the plan proposed should be adopted, they might be dispensed with, although their present elevation has been fully established, by the Supreme Court, in three suits at law, brought by the proprietors of the Sudbury meadows, who are fully in the belief that, should the said flash-boards be removed, their property, to the amount of some thousand acres of land, would be relieved from flowage, and thereby greatly enhanced in value, as it would produce a better quality of grass. The rights of the canal to these flash-boards have been of so long standing, and so completely confirmed by judicial decisions, that there is no possibility of the meadow proprietors obtaining any relief, without some compromise with the canal proprietors. In dry seasons, it is not possible to operate the canal without them. In fact, if the canal, as such, is to be kept in operation, they are indispensable in maintaining the required head of water, at the summit level. One property or the other had to yield, and the courts have decided the case forever. By the proposed change, the navigable canal would be converted into an aqueduct for the

supply of water to the city of Boston, and, for a reasonable equivalent, relief might thus be afforded the meadow proprietors, should these views be correct. By the accurate survey of the best engineers, there is, now, a fall, of only three feet, in the Concord river, from Sudbury to Billerica mills, a distance of twenty-two miles. This trifling fall in so great a distance, together with many extensive and wide places, and, on the other hand, some very narrow and crooked ones, besides fifteen or sixteen public bridges, whose piers and abutments are erected in the river, all tend to impede the progress of the water. There is also an extensive bar of sand, at Concord, nearly a quarter of a mile in length, and situated a little below the junction of the Assabet river with the Concord, or main stream. The tributary swells rapidly in heavy rains, and, by its great descent, carries with it large quantities of sand washed from its banks, which is deposited, after mingling with the sluggish waters of the Concord. This annually increases the bar. In one instance, the flood was so great that it lifted a bridge from its abutments, which, on entering the Concord, was actually carried *up stream* to a considerable distance; the same being caused, no doubt, by a strong current of wind blowing at the time in that direction. Should this bar in the river be removed, and the flash-boards taken off, a large tract of land might in all probability be reclaimed and greatly enhanced in value. By reference to the plans, it will be seen how admirably calculated this river and the canal are for the supply of water, free from the impurities of mineral and vegetable matters. The velocity of the water, extending from the outlets of the great ponds at Framingham, Wayland, Natick, and from the Assabet river, a distance of thirty miles or more, is so gentle, that every substance, not of the same specific gravity of the fluid, must either float on the surface, and be driven by wind to the shore, or be deposited at the bottom. The canal commences at Billerica mills, and before reaching Woburn, at Horn pond, it passes through three levels, of twelve miles distance. The first level is four miles, the second two miles, and the third six miles in length. The water being slow in its motion, they thus constitute, to a certain degree, three settling ponds or reservoirs. Compare such with the reservoirs of the Fairmount works at Philadelphia, which consist of four or five little ponds of about one acre each. The Concord river has other and important advantages for the supply of water, one of which must be apparent to every one who is conversant with the topography of the country through which it passes. Its course is directly on the highest ridge of land to be found between the Merrimac and Shawshine rivers. The former is

twenty-four feet, and the latter twenty-two feet below the Concord; therefore a great proportion of the foreign and surface matters is, by rains, carried from instead of into it. At Long pond, one of its feeders, it is found, from actual survey, that a canal could be made of only about one mile in length, which would carry the waters of that pond, by a regular descent, into the Charles river.

An idle story has been circulated in regard to the water of Concord river's containing some deleterious substance, which would cause a wound, by contact with it, to '*fester*,' or become greatly irritated. The same tradition adds, that, washing the part, so exposed, in the waters of the Merrimac, would soon restore it. Carpenters, and other mechanics, who have been constantly employed on the works of the canal, and who have been a great many times in this water during the past thirty years, have experienced no such trouble, having daily washed in, and otherwise used it. From experience, and inquiries made for the past twenty years, I have not been able to find the origin of this fabrication. It is not impossible but that the blood of the person who originated the story might have been overheated by the too frequent use of '*strong water*,' particularly when it was sold by authority, and used with impunity. Science establishes facts, incontrovertible by fable; and the analyses of four able and practical chemists, are certainly more to be depended on than all the idle tales that ignorance and prejudice can create. The reports of Drs. Charles T. Jackson, of Boston, John W. Webster, of Cambridge University, S. L. Dana, of Lowell, and A. A. Hayes, Esq., of the chemical works at Roxbury, are to be found in the Appendix.

Certain questions having arisen in regard to the title of the lands held by the proprietors of the Middlesex canal, and with respect to the powers vested in the Legislature to alter and amend the original charter, so as to make it applicable to any other public use that might be contemplated, I addressed a letter, setting forth the queries in detail, to the Honorable Jeremiah Mason, whose opinion and knowledge of law would be as much respected as that of any other man in his profession. Such questions, together with his answers thereunto, will be found in the Appendix. There yet remain others of some importance to be decided by the party in interest, viz., Has the time arrived when the health, safety, and convenience of the inhabitants of Boston require a full and better supply of water, the great promoter of health and element of life? Is it practicable, without additional burdens in the shape of taxes on those who prefer property, to health, cleanliness, and convenience? Can it.

and is it not better to be accomplished by a joint stock company than by the city in its corporate capacity? I will hazard one assertion, and I believe the experience of the past will prove its correctness, viz., that should the work be undertaken by the city, in the usual manner of conducting such enterprises, the expenditures would be, at least, one third more than if managed by a company whose direct interests would be involved. To enable the proprietors to form opinions somewhat satisfactory, I have made estimates for their consideration, stating distance, cost of materials, labor, the elevations of reservoirs, &c. &c.

ESTIMATE.

Distance from Woburn upper lock to reservoir, 2,250 rods,	37,125 feet.
Height of water at Woburn upper lock, above wharf level in Boston,	86 "
Height of reservoir at Windmill hill, East Cambridge,	60 "
Conduit pipe, 30 inches diameter delivery, by Prony's formula, of $Q = 38.116 \sqrt{D^5}$ }	6,459,264 gallons per day.
Whole length of conduit pipe to be purchased, in order to lay 37,125 feet,	39,309 feet.
Distance from reservoir to Boston side of Charles river, 600 rods,	9,900 "
Distance of pipe required to lay 9,900 feet,	10,482 "
Cost of 30 inch pipes, 39,309 feet, at \$6 per foot,	\$235,854 00
Lead for 4,368 joints, 127 lbs. each, at $3\frac{1}{2}$ cents per lb., 554,746 lbs.,	19,416 11
Laying 4368 pipes leading the same, \$2 each,	8,736 00
Covering and trenching, \$2,	8,736 00
Cost of 10,482 feet pipe, from reservoir to Boston, 30 inch pipe, at \$6,	62,892 00
Lead for 1165 joints, 127 lbs. each, 147,955 lbs., $3\frac{1}{2}$ cents per lb.,	5,178 42
Laying 1165 pipes, \$2,	2,330 00
Covering and trenching, \$2,	2,330 00
Oakum for all the pipes,	500 00
Land and cost of reservoir,	50,000 00
Crossing Charles river,	25,000 00
Cost of 800 shares in canal, at \$100,	80,000 00
Engineering, land, and incidentals,	47,027 47
Distribution in city,	250,000 00
	<hr/>
	\$900,000 00

Eight hundred shares appropriated to pay for canal, set off to present proprietors of canal, as paid in full,	\$80,000 00
Eight thousand two hundred new shares for subscribers, at \$100,	820,000 00
	<hr/>
	\$900,000 00

Five thousand tenants, at 200 gallons per day each, at \$10 per annum,	\$50,000 00
Ten thousand tenants, at 200 gallons per day each, at \$10 per annum,	100,000 00
Fifteen thousand tenants, at 200 gallons per day each, at \$10 per annum,	150,000 00

It is estimated that there are, in Boston, about 14,000 houses, besides stores, work-shops, manufactories, printing offices, stables, &c. &c., requiring water. There were built the past year, (as per statement of the present city marshal,) without including work-shops, temporary buildings, &c., as follows :

BOSTON.

Brick houses and stores,	544	
Wooden " "	194	
Stables, &c.,	56	
Brick school-houses,	4	
Brick churches,	1	
Wooden churches,	2	
Other large buildings,	6	
	<hr/>	807

SOUTH BOSTON.

Catholic church,	1	
Brick houses,	5	
Wooden houses,	142	
" stores,	2	
" work-shops,	4	
	<hr/>	154

EAST BOSTON.

Wooden houses,	150	
Brick "	7	
	<hr/>	157
		<hr/>
Total,		1118

An increase over the previous year of about 300.

It now becomes important to ascertain what has been the past increase of inhabitants in the city of Boston, in order that a correct estimate may be formed as to its future growth, and probable demand, from time to time, of water for all purposes. I have compiled a table, commencing with the year 1700, and showing, from positive data and undoubted authority, the advance, in number, of the population, from that period to the year 1840. It will be seen, by examining the table, that, during the ten years previous to 1840, the ratio of increase was a little more than fifty per cent.; the ten years previous, over forty per cent.; the twenty years, from 1800 to 1820, about thirty-four per cent. Why should the increase have been so much larger during the ten years previous to 1840? There can be no question that it arose from the great facilities offered by internal improvements, — rail-roads, manufactories, steam-boats, &c. &c., all of which, during that period of time, advanced with a rapidity that even astonished the projectors thereof; and although great errors, and, in many cases, waste in expenditures, often occurred, yet nearly all these additions to wealth, created by labor, now yield a fair interest upon the cost, and a safe investment for the capitalist. If the city, for the ten years preceding 1840, increased in population in amount fifty per cent., are we not authorized to predict that, with the present facilities, the increase for the next fifty years will be, *at least, thirty-three and one third per cent.* in each ten years thereof? which, in fact, is about the average rate since the year 1700. I have added a table, showing the results of such a rate of increase, which corresponds very nearly with that of the United States, for the past century.

Table 1, exhibiting the actual increase.

In the year 1700 — 7,000 inhabitants, and 1,000 houses.			
"	"	1722 — 10,567	"
"	"	1742 — 16,382	"
"	"	1752 — 11,574	"
"	"	1765 — 15,520	" and 1,676 houses.
"	"	1790 — 18,038	"
"	"	1800 — 24,937	" about 30 per cent.
"	"	1810 — 33,250	" " 34 "
"	"	1820 — 43,298	" " 34 "
"	"	1830 — 61,392	" " 41 "
"	"	1840 — 93,383	" " 50 "

Table 2, exhibiting the increase, from 1840 to 1890, at 33½ per cent.

In the year 1840 —		93,383 inhabitants.
		31,127 increase 1st 10 years.
" " 1850 —		124,510
		41,503 increase 2d 10 years.
" " 1860 —		166,013
		55,334 increase 3d 10 years.
" " 1870 —		221,347
		73,719 increase on 4th 10 years.
" " 1880 —		295,086
		98,362 increase on 5th 10 years.
" " 1890 —		393,448

The number of houses necessary to a population of 393,448, at the rate of seven to each house, (which was about the average number during the years 1700 and 1756) would be fifty-six thousand two hundred and seven; for all of which, water would be required, as well as for stables, manufactories, stores, and various purposes too innumerable for expression here. At the same rate of calculation, there would now be in the city, about thirteen thousand three hundred and forty dwellings, which, in all probability, is about the real number, without including stables, workshops, warehouses, stores, etc.

The above statement, or estimate, shows that there would be 56,207 tenants requiring to be supplied with water in some way or other; and, should only one quarter part of them become subscribers, the number would exceed 14,000, exclusive of stables, manufactories, &c.

Boston is situated on a peninsula, and contained, at the time when first occupied by Blackstone, an area of about six hundred acres of upland. It now covers an extent of surface of about twelve hundred acres, about half of which has been produced by filling up flats and marshes, formerly covered by the tide waters. The city, as it exists at present, has been circumscribed by an imaginary line, extending to the channels around it; and beyond such line no structure is permitted to be erected, in or over the water. Not a piece of land, amounting to an acre in magnitude, can now be found, within the confines of the city, not covered by buildings, or which is not occupied by the present inhabitants, amount-

ing, in all, to about one hundred thousand in number. The future and increasing population will demand *where they are to go*. The answer must be, 'To the *South*, upon the Neck lands,' at first; and, in course of time, upon lands produced by filling up the Mill basins of the Boston and Roxbury Mill Corporation—all of which, in acres, exceed Blackstone's original farm. Another inquiry will then be, as it now is, with respect to the present Mill pond lands, at the North part of Boston, as well as at the South cove, where it cost 700 to 1000 dollars to obtain a well of even bad water—'How shall we obtain that element so indispensable to health and life?'

The inhabitants of the city of New York have expended the enormous sum of twelve millions of dollars, or thereabouts, in order to obtain a full supply of water. They have borrowed the money, and are now paying an annual interest thereon, and by direct taxation upon their property. This, at first view, would seem calculated to alarm the owners of both real and personal estate; but, when duly and properly considered, it, in reality, takes little or nothing from their pockets. Immediately upon the introduction of a full supply, by the Croton aqueduct, the fire insurance offices voluntarily reduced the premiums of insurance twenty-five per cent.; which, estimated upon all the assurable property both real and personal, would amount to a sum greatly exceeding the interest on the cost of the aqueduct, thus giving, as it were, *free of cost*, to every inhabitant, the use of that element so indispensable to cleanliness and health. What difference can it possibly make to the citizen whether he pays his money for *water* or for *extra insurance* against fire? There can be no doubt, had New York been as well supplied with water when the great fire took place, but few years since, as it now is, that the amount of property which might and would have been saved thereby, would equal, if not greatly exceed, the whole cost of the Croton aqueduct. This magnificent work gives such a character to the city, that merchants, at a distance, feel a greater confidence in consigning their property to it for sale. The saving of insurance to them is certainly no inconsiderable amount.

How is it with Philadelphia? Her city councils have expended thirteen or fourteen hundred thousand dollars in constructing the Fairmount water-works, and which, in all probability, by the sale of water at moderate prices, will be redeemed or paid for in twenty years from the time of their completion. Other advantages accruing need not be named, although appreciated they must be.

The advantages of good water, in a commercial city, must be apparent to every considerate owner of navigation. The health

of his crews greatly depends on the purity of this element; the safety of his property on the health of his officers and crew, especially while on distant voyages, in hot climates, where water is difficult to be obtained in a pure state.

There are yet other and important questions for decision.

First. In what way can this enterprise be effected, and how are the means to be provided? The answer is as follows:—The present stock of the Middlesex Canal is divided into eight hundred shares. Value these shares at one hundred dollars each,* for that part of the canal leading from Concord river to Woburn, and allow each individual of the present company to hold the same number of shares in the proposed aqueduct, the same to be considered as paid in full, and subject to no assessments. Add to the said eight hundred shares, by new subscription, nine thousand two hundred more, at one hundred dollars each, making, in all, a capital of ten hundred thousand dollars. Give to the present proprietors of the Middlesex Canal the first right of subscription to the amount of two thirds the whole of the stock, and the remainder thereof to the city authorities; whatever remained not subscribed for might be offered to the citizens generally, who may be disposed to favor an object so interesting and beneficial.

The legislative acts, required to carry out the project, ought to be drawn with great care, and will require the hand of some experienced, and professional man, one more conversant with instruments of that character than myself.

In their several sections they may contain as follows :

1. The right of discontinuing those parts of the present canal leading from Charles river to Woburn, at Horn pond, and from Billerica mills to the Merrimac river, at North Chelmsford, or such other part as may be deemed necessary ; whenever the proposed aqueduct shall be commenced or completed, and the water introduced into any part of Boston ; and the same without incurring any damages on account of said discontinuance.

2. The right of discontinuing the use of that part of said canal lying between the Concord river and Woburn, at Horn pond, or any other part thereof, as a navigable canal ; the same to be used, (after notice of such discontinuance,) as an aqueduct, and without incurring any damage for the use of the waters of the Concord river, for supplying the city of Boston and the

* These shares actually cost \$1455.25 ; and that part of the canal, used for aqueduct purposes, herein estimated at \$80,000, in value, could not be constructed, at the present time, for \$800,000. All the property, belonging to the proprietors of the Middlesex Canal, if sold, would add from 50 to 70 dollars to each share, so that they would derive about 150 to 170 dollars for what actually cost \$1455.25.

towns of Charlestown and East Cambridge, and the United States navy yard: provided, the proprietors interested in said aqueduct shall not enlarge, in any way, their canal gates at the Concord river, so as to draw a greater quantity of water than they now can draw, or have ever had a right to draw, for the purposes of a navigable canal.

3. All the lands, lying between the Concord river and Horn pond, in Woburn, and which have been taken and paid for, by appraisement of a county committee, and held in fee simple, or otherwise, to remain as the property of the proposed aqueduct company, and be subject to no farther claims or damages by reason of the change, different use, or application of the waters of the Concord river.

4. The proprietors of the aqueduct, when completed, to be liable to maintain all public bridges connected with county or town roads, which may pass over said aqueduct, and which have been heretofore maintained by the proprietors of the Middlesex Canal.

5. The act, together with the act of incorporation, to be null and void, unless approved and accepted by the owners of a majority of the shares in the Middlesex Canal within five years from the date thereof; and, if not so accepted and approved, the canal proprietors to retain the same rights as they now hold under their present charter.

6. Certain provisions, setting forth all the rights and privileges contained in a charter [see Appendix] granted to William Sullivan, Daniel P. Parker, and Caleb Eddy, entitled, An act to incorporate the Boston Hydraulic Company, approved by the governor of the Commonwealth on the sixteenth day of April, 1836.

The construction of the Middlesex Canal was a heavy undertaking to its proprietors. It was built in good faith, and has ever been conducted with a strict regard to public accommodation. When the Lowell rail-road charter was petitioned for, the proprietors of the Canal respectfully remonstrated against the grant thereof, without it should contain a provision for some reasonable indemnity to them, for the injury they were doomed to sustain. I would ask, if the same Legislature did not require that individuals, who might sustain any injury whatever in their property, by reason of the acts and doings of the rail-road corporation, should be indemnified? In laying a road, by virtue of law, on or over a person's land, the *fee* of the land is not taken from him; but he is deprived of obtaining any income from it, while the road is continued over the same; the award of the com-

missioners being generally the amount, or nearly so, of the property. On *discontinuing* the road, the property reverts to him, and he again can derive an income. Now, by granting the right of constructing a rail-road by the side of the canal, the proprietors are deprived of the means of an income. *Why should they not have some reasonable remuneration?* They expended their money in purchasing lands, honorably paying all damages, and building the canal. Did the *landholder* do more than pay for the property which he, by the act, was deprived of getting his usual income from? Why, then, should there not have been a provision in the act for a reasonable indemnity by the rail-road or State? There were certainly as strong grounds for it as there were for the State to pay \$25,000 as an indemnity to the proprietors of the Charles river bridge. By the grant of another charter, to another corporation, to build a new bridge, they virtually destroyed the income from the old one. The only reason set forth for so doing, was, that of public convenience; exactly the same which was maintained by the petitioners for the Lowell rail-road, in asking for a charter for their road. There is only one difference in the two cases. The proprietors of Charles river bridge had received over and over again the cost of the bridge, and interest on the same, whilst the proprietors of the canal have received but *one and thirty-nine hundredths of one per cent. interest* on the cost; their whole expenditure, by the unreasonable act of the Legislature, being now rendered of nominal or little value.

Again, when the Legislature granted, to the proprietors of the Lowell rail-road, the right to build said road by the side of the canal, parallel with and calculated to destroy it, and without any indemnity by the State, or otherwise, to the canal proprietors, they did, at the same time, confer a special, unusual, and exclusive privilege upon the proprietors of the rail-road, viz.: by inserting, in their charter, a provision that no other rail-road should be constructed within five miles of theirs, during the ensuing period of thirty years. Had no such provision been inserted in the rail-road charter, the canal proprietors might, at this time, (with almost a certainty of great profit,) place iron rails upon their canal line; and no one can suppose that a little competition, created thereby, would be very detrimental to the public interest. But it was thought best to plunge the knife, to the hilt, into the existing rights of the canal proprietors, and to provide a coat of mail for the rail-road, in order that future Legislatures might not allow similar privileges to others, which they thought right to grant to the Boston and Lowell Rail-Road Corporation.

As things exist at present, can the Legislature, or will it, be dis-

posed to do less than grant you the right to use the canal *for another and beneficial public use*, as now proposed, should you, after mature consideration, think it advisable to apply for such power? Or, in view of the above, I would respectfully suggest, for your further consideration, the propriety of a *direct application to the State authorities for a grant of money from the State treasury, to indemnify the canal owners for the loss they have sustained by the acts of the Legislature, done, as they were, under the pretext of public weal.*

In making the above statements to the proprietors of the Middlesex Canal, the agent is actuated by no personal interest. He is not now, nor has he ever been, during the nineteen years of his agency, the owner of a single share in the canal; yet he feels it his duty to give, to the proprietors, such information as his practical knowledge affords; in order that they may be enabled to judge as to what, in future, their interest may require, and the course best to be pursued, to save, as far as possible, a property that would have been valuable, indeed, had it not been reduced by a new mode of transportation, in which steam power is made to take the place of animal power, and, though moving at much greater speed, is equally as cheap. There are considerations which induce the merchant to prefer rail-road to canal transportation; and, at this time, nothing but cheap and bulky lumber and fuel remain to be borne upon the waters of the canal. Such articles, being of little value in comparison with many others, cannot afford to pay a high rate of toll. The Middlesex does not possess the advantages of a large and long canal, like the New York and Erie, on which boats, carrying fifty to sixty tons freight, are moved at the same expense as those on the Middlesex, which carry but one third that quantity. A serious inconvenience attends the Middlesex. It terminates at the Merrimac river, into which the boats are passed which are bound to Concord and intervening towns, and it frequently happens that they are detained by freshets in said river, one, two, or three weeks, before reaching their destination, thus creating such an uncertainty in the receipt of goods that the merchant will not risk his property therein, when, within twenty-four hours, he can receive it into his store, by means of a rail-road, running the whole distance, and incur no risk of its being sunk in the river, or otherways damaged by water. Before the rail-roads were constructed, the merchants of New Hampshire and Vermont were in the habit of purchasing heavy stocks twice a year, viz.: during the Spring and Fall. They were obliged to lay in heavy amounts for so great a length of time, and were subject to considerable loss in interest in consequence

thereof. The said merchants, by the facilities now afforded, visit Boston generally once a month, buying only such goods as are immediately required. This enables them to do the same amount of business on much less capital, and to run less risk on a falling market; besides, on a rising one, they leave home in the morning, and arrive in the city as soon as the Boston merchant reaches his place of business, make their purchases the same day, sleep at home at night, and on the morning following, their goods are at the storehouse in Concord. The spirit of enterprise is such, and the principle of advance so engrafted and firmly set upon the Anglo-Saxon race, that we can hardly believe the present and future generations will ride in carts drawn by oxen, (as their forefathers did before them,) when they can, with greater ease and less expense, travel the same distance in handsome and convenient coaches, and in one twentieth part of the time.

Boston may be compared to the hub or nave of a wheel having rail-roads for its spokes, and the boundary line of the United States for its fellow or periphery. Its wealth, produced by commerce and manufactures, is the axle, by use constantly expanding itself, and rendering it able to sustain the exact burden required. By the retrospect we are taught something of the future. In the year 1700, Boston contained 7000 inhabitants. Seventy years before that period, one individual owned the whole peninsula, and sold it for a sum less than is now asked, in many situations, for a superficial foot. Whoever lives to see it at the end of the next half century, will find himself one among a population of four hundred thousand, at least. Will they want water?

I make this communication with diffidence, knowing the responsibility; and I would not be understood as urging the proprietors to adopt the measures proposed, without a full and satisfactory investigation being had in the premises. On mature consideration it may be thought the best policy, under the circumstances in which the canal is now placed, to operate, the same as heretofore, for a year or two, or even for a longer period of time, by way of experiment, even should it not produce more than enough to pay for the repairs, and other expenses, which must incur in its use; and the same in the hope that it may improve, and the results be different from those at present anticipated. It may be thought best to surrender the charter, to wind up the concern, sell the property, and divide the proceeds. Should the Legislature be disposed to help you out of the difficulties you are now laboring under, owing to their own acts, and to grant

the full and unrestricted right of using a part, or the whole, of the canal for supplying the city with water, it will be the best policy to keep the canal in operation until the completion of the new works, both for public accommodation and your own convenience, in transporting the iron pipes, and other articles, that will be required. So far as my feeble abilities and physical strength can aid in promoting the interest of the proprietors, they certainly shall be exerted.

CALEB EDDY,

Agent of the Middlesex Canal Corporation.

APPENDIX.

Assessments for building Middlesex Canal, made up with interest to date of first dividend, February 1st, 1819.

Date.				Assessment.	Months.	Interest to Feb. 1, 1819.	Amt. assessed.
January	1	1794	1	assessment	301	3 01	2 00
May	1	"	2	"	297	4 45	3 00
September	1	"	3	"	293	2 93	2 00
October	1	"	4	"	292	4 38	3 00
February	1	1795	5	"	288	7 20	5 00
March	1	"	6	"	287	7 17	5 00
April	1	"	7	"	286	7 15	5 00
May	1	"	8	"	285	7 12	5 00
June	1	"	9	"	284	7 10	5 00
July	1	"	10	"	283	7 07	5 00
August	1	"	11	"	282	7 05	5 00
November	1	"	12	"	297	6 98	5 00
December	1	"	13	"	278	6 95	5 00
March	1	1796	14	"	275	6 87	5 00
May	1	"	15	"	273	6 82	5 00
June	1	"	16	"	272	6 80	5 00
July	1	"	17	"	271	6 78	5 00
October	1	"	18	"	268	6 70	5 00
October	1	"	19	"	268	6 70	5 00
October	1	"	20	"	268	6 70	5 00
December	1	"	21	"	268	6 65	5 00
May	1	1797	22	"	261	6 52	5 00
June	1	"	23	"	260	6 00	5 00
October	1	"	24	"	256	6 40	5 00
November	1	"	25	"	255	6 37	5 00
December	1	"	26	"	254	6 35	5 00
July	1	1798	27	"	247	6 13	5 00
July	1	"	28	"	247	6 17	5 00
July	1	"	29	"	247	6 17	5 00
July	1	"	30	"	247	6 17	5 00
October	1	"	31	"	244	6 10	5 00
October	1	"	32	"	244	6 10	5 00
December	1	"	33	"	242	6 05	5 00
April	1	1799	34	"	238	5 95	5 00
April	1	"	35	"	238	5 95	5 00
June	1	"	36	"	236	5 90	5 00
June	1	"	37	"	236	5 90	5 00
September	1	"	38	"	233	5 83	5 00
September	1	"	39	"	233	5 83	5 00
September	1	"	40	"	233	5 83	5 00
November	1	"	41	"	231	5 78	5 00
November	1	"	42	"	231	5 78	5 00

March	1	1800	43	assessment	227	5 67	5 00
March	1	"	44	"	227	5 67	5 00
March	1	"	45	"	227	5 67	5 00
June	1	"	46	"	224	5 60	5 00
June	1	"	47	"	224	5 60	5 00
June	1	"	48	"	224	5 60	5 00
November	1	"	49	"	219	5 48	5 00
November	1	"	50	"	219	5 48	5 00
November	1	"	51	"	219	5 48	5 00
November	1	"	52	"	219	5 48	5 00
November	1	"	53	"	219	5 48	5 00
March	1	1801	54	"	215	5 38	5 00
March	1	"	55	"	215	5 38	5 00
March	1	"	56	"	215	5 38	5 00
March	1	"	57	"	215	5 38	5 00
August	1	"	58	"	210	10 50	10 00
August	1	"	59	"	210	10 50	10 00
August	1	"	60	"	210	10 50	10 00
August	1	"	61	"	210	10 50	10 00
August	1	"	62	"	210	10 50	10 00
December	1	"	63	"	206	10 30	10 00
December	1	"	64	"	206	10 30	10 00
December	1	"	65	"	206	10 30	10 00
December	1	"	66	"	206	10 30	10 00
June	1	1802	67	"	200	10 00	10 00
June	1	"	68	"	200	10 00	10 00
June	1	"	69	"	200	10 00	10 00
June	1	"	70	"	200	10 00	10 00
June	1	"	71	"	200	10 00	10 00
June	1	"	72	"	200	10 00	10 00
			73				
October	1	"	74	4 assessments.	196	24 50	25 00
			75				
			76				
			77				
May	1	1803	78	7 assessments.	189	56 70	60 00
			79				
			80				
			81				
			82	"	189	9 40	10 00
June	1	"	83				
			84				
			85				
November	1	"	86	4 assessments.	183	36 60	40 00
			87				
			88				
			89				
May	1	1804	90	3 assessments.	177	22 12	25 00
			91				
			92				
November	1	"	93	3 assessments.	171	12 83	15 00
			94				
			95				
February	1	1805	96	"	168	4 20	5 00
May	1	1806	96	"	153	7 00	10 00
			97	3 assessments.	89	22 25	50 00
September	1	1811	98				
			99				
September	1	1817	100	"	17	6 80	80 00
						705 25	750 00
						705 25	705 25

The actual cost of each share to the date of 1st dividend, \$1455 25

DIVIDENDS PAID FROM FEBRUARY 1, 1819, TO JANUARY 30, 1843.

February	1	1819	1	Dividend	\$15 00
March	15	1820	2	"	10 00
January	31	1821	3	"	10 00
January	16	1822	4	"	20 00
January	8	1823	5	"	15 00
January	6	1824	6	"	15 00
January	8	1825	7	"	12 00
January	20	1826	8	"	15 00
January	22	1827	9	"	9 00
January	19	1828	10	"	9 00
January	28	1829	11	"	10 00
February	1	1830	12	"	8 00
February	1	1831	"	No dividend	
January	21	1832	13	Dividend	22 00
January	28	1833	14	"	20 00
January	31	1834	15	"	30 00
January	19	1835	16	"	30 00
January	25	1836	17	"	30 00
January	25	1837	18	"	30 00
January	23	1838	19	"	20 00
January	22	1839	20	"	20 00
January	24	1840	21	"	18 00
January	27	1841	22	"	10 00
January	28	1842	23	"	16 00
January	30	1843	24	"	10 00
					<hr/>
					\$504 00

REMONSTRANCE OF THE PROPRIETORS OF MIDDLESEX CANAL,
AGAINST THE GRANT OF A CHARTER TO BUILD A RAIL-ROAD
FROM BOSTON TO LOWELL.

*To the Honorable the Senate and House of Representatives in
General Court assembled.*

THE President, Directors, and Company of the Middlesex Canal having seen the publication of the Petition of John F. Loring and others, for a rail-road from Boston to Lowell, and the order of notice thereon, beg leave to present the following remonstrance to granting the prayer thereof.

In the year 1793, a number of persons were incorporated, for the purpose of making a canal from Merrimac river to Boston. The corporation was duly organized, and the work was undertaken. When it had been completed for the aforesaid distance, it was found that it was necessary to make the Merrimac navigable for boats into the interior of New Hampshire, and the corporation, jointly, with some individuals, undertook to effect that object. The individuals who engaged therein were mostly proprietors in the Middlesex Canal, and were induced to engage in these new works, in the hope of rendering the Middlesex Canal productive. That the Middlesex Canal Corporation contributed in the following proportions to build locks and make canals on the Merrimac; all of them, except the first mentioned, being within the State of New Hampshire.

1. Wiccasee Locks and Canals, exclusively the corporation's cost,	\$12,000
2. - The proportion of seventy-three shares in eighty-three shares in the Union Locks and Canals, which originally cost \$56,772 73. Middlesex Canal's proportion,	49,932
3. Forty-five shares in one hundred in the Isle of Hookset Canal, which cost \$15,000. The proportion of Middlesex Canal,	6,750
4. One hundred and six shares in one hundred and fifty-seven in Bow Canal and Locks, whole cost \$21,000. Middlesex Canal proportion,	14,115
	<hr/> 82,797

Thus the actual expenditure of the Middlesex Canal Corporation in these several works amounts to \$82,797 00
Which sum was derived from the income of the Middlesex Canal, up to the year 1818, during all

which time no dividends were made: this comprised a period exceeding twenty years from the commencement of the making of the Middlesex Canal. That the interest on the amount expended in making the Middlesex Canal, and in making the river canals, is supposed, (in a general view, sufficiently accurate for the present purpose,) to have amounted up to the year 1818, to

Amount paid for Middlesex Canal assessments,	450,000
	580,000
	\$1,112,797

Making the whole cost of each share about \$1391. That from the year 1818 to the present time, dividends have been declared in the Middlesex Canal, of various sums, averaging twelve dollars and thirty-three cents on a share, annually. So that from an experience of eleven years the actual value of the property is a capital of \$206 to a share, at six per cent., and consequently, that there is a loss of the difference between \$1391 and \$206, which is \$1185. The difference between the gross receipts and the sum divided has been appropriated to repairs, and gradual renovation of the works which were originally of wood, but have been, in many instances, converted into *stone* — as the renovations became practicable and expedient; and the works will, with little more expenditure, become so permanent, as to require but a small sum for annual repairs. The improvements and renovations have been made in so substantial a manner, that if there should be no increase of transportation, the fair average value of a share would be, at least, \$300, leaving the absolute loss in future, on this supposition, to be only \$1091 on each share, amounting on eight hundred shares to \$872,800! It will thus be seen, that an enterprise originally undertaken by public-spirited men for the general good, has failed to produce the intended effect; and has occasioned a very heavy loss to them. * Many of the present proprietors are heirs of the original owners, and have been holding this property in the hope that the increase of income would eventually be some indemnity for the original loss. And a class of other proprietors have come in, under the belief that the canal had been so long before the public, and had been so far tested by the experiment of many years, that it was a safe investment, and a permanent and an increasing one; and some persons acting for females and others, have invested money in this corporation, and at this time, out of eight hundred shares, four hundred are held by females, many of whom hold by heirship, under

original proprietors. The proprietors, aforesaid, further respectfully represent, that their costly experience has forced on them the conviction, that transportation by any other mode than by the common road, on common vehicles, cannot be profitable, compared with the unavoidable cost in an *agricultural country*, in which the means of transportation constitute a part of the ordinary stock necessary in agriculture; because these means of carrying can be used at a cost which is less than can be afforded on any artificial way. But when the artificial mode is extended far into the interior, there will be places of deposit at the extremities, and the convenience and the saving are sufficiently attractive to exclude the ordinary modes of transportation, and then there may be income enough to justify the expenditure for artificial ways. The remonstrants have heretofore believed that such a case would exist if there were a canal or rail-road from Concord, in New Hampshire, (which is the present limit of the canal carriage,) across to the Connecticut river, a distance not exceeding fifty miles; and they found their belief on the supposition, that the whole of the upper valley of the Connecticut river would find it profitable to come down to the artificial way, on the eighty or one hundred miles of that river, which is now boatable, and then avail of the artificial way across to Concord, and thence to Boston. And they have, also, believed that this would open a way to the city of Boston for a great internal commerce, which is beyond the influence and attraction of the great market of New York; and this belief has been further strengthened by the supposition, that if the only remaining obstacle, which is, the connecting of the Merrimac and the Connecticut, were removed, that the trade with Canada, and finally that with the great western lakes, would be secured. The remonstrants have long entertained the opinion, that the public enterprise of the citizens of Boston, and some of New Hampshire and Vermont, would finally develop itself in this great work, under the patronage of this State, and with such aid as might be expected from the United States.

With such views, the remonstrants have upheld and maintained the water carriage to and from Concord, in New Hampshire, and have awaited the ripening of public opinion, as to the best modes of facilitating an intercourse with the interior.

In this state of things, the remonstrants have been surprised by a petition for a rail-road from Boston to Lowell, and are much embarrassed to decide what course it may become them to adopt, on this occasion; on the one hand, they are exceedingly reluctant to present any objections to any theories of public improvement, especially at a time when the best minds in the

country seem to be intent on effecting something; but on the other hand, they respectfully venture to intimate, that there must be some limit, in point of rational principle, to the making of new adventures, under public sanction, to the serious injury of those undertaken in the favor of similar auspices. There are certain acts which all the citizens of a community are held to perform: as the making of roads for free use; the maintenance of schools; paying due proportions of all common charges. There are some other acts which are undertaken by public authority, by individuals, in the hope of remuneration, as turn-pikes, and a multitude of other enterprises, designed for the purpose of public accommodation, or for those who choose to avail of them; and to give to the projectors a remuneration through the voluntary use, where the latter description of acts were done, it seems reasonable that no *mere substitute* for the established accommodation should be allowed, without an obvious necessity. If this be not so, it would seem that the patrons of the public welfare, and of private and expensive enterprise conducted under this patronage, will discourage all efforts of private persons to adventure for the public good. Before a new grant is made, in the nature of such substitute, it would seem to be no more than natural justice, that the necessity for such substitute should be most obvious and imperative.

The remonstrants take pleasure in declaring, that they join in the common sentiment of surprise and commendation, that any intelligence and enterprise should have raised so rapidly and so permanently, such establishments as are seen at Lowell; and they cannot forbear to add their testimony of the estimable talent, and respectable use of it, which distinguish the authors of these magnificent works. But they must also add, that the proprietors of these works have availed themselves of *the canal*, for their transportation for some years for all articles, except in the winter months, and except, also, some light manufactured articles; that every effort has been made by this corporation to afford every facility, and it was hoped and believed, to the entire satisfaction of the Lowell proprietors. The average annual amount of tolls paid by these proprietors has been only about four thousand dollars. It is believed that no safer or cheaper mode of conveyance can ever be established, nor any so well adapted for carrying heavy and bulky articles. To establish, therefore, a *substitute* for the canal alongside of it, and for the whole distance, and in many places within a few rods of it, and to do that which the canal was made to do, seems to be a measure not called for by any exigency, nor one which the Legislature can permit, without implicitly declaring that all investments

of money in public enterprises must be subjected to the will of any applicants who think that they may justly benefit themselves, and that they may do it without regard to older enterprises, which have a claim to protection from public authority. With regard, then, to transportation of tonnage goods, the means exist for all but the winter months, as effectually as any that can be provided. "There is a supposed source of revenue to a rail-road, *from carrying passengers*. As to this, the remonstrants venture no opinion, except, to say, that passengers are now carried, at all hours, as rapidly and safely as they are any where else in the world; and if the usual time consumed in passing from one place to the other, be three hours — there seems not to be any such exigency to make that space of time half what it now is, as to justify the establishment of a rail-road for that purpose merely, if the establishment would, as it is thought it must, draw after it, eventually, all other transportation. To this, the remonstrants would add, that the use of a rail-road *for passengers only*, has been tested by experience, nowhere, hitherto; and that it remains to be known, whether this is a mode which will command general confidence and approbation, and that, therefore, no facts are now before the public, which furnish the conclusion, that the grant of a rail-road is a public exigency, even for such purpose. The Remonstrants would also add, that so far as they know and believe, there never can be a sufficient inducement to extend a rail-road from Lowell westwardly and northwestwardly, to the Connecticut, so as to make it the great avenue to and from the interior, but that its termination must be at Lowell, and, consequently, that it is to be a substitute for the modes of transportation, now in use, between that place and Boston, and cannot deserve patronage from the supposition that it is to be more extensively useful."

The experience of the Remonstrants justify them in asserting, that there is no subject on which the theory and the practice of transportation by artificial or facilitated modes, are more at variance. The Remonstrants fully believe, that if they could extend canal carriage to Concord, and make the expense of transportation from that point to Boston about one-half of that in the usual mode, that the great trade which is carried on with Boston, and the country north and west of Concord, would concentrate at the latter place; that wagoning would terminate at that point, and that boating only would be used thence to and from Boston. Experience has demonstrated, that more than two thirds of all that passes to and goes from Boston *through the town of Concord, still goes on wagons — notwithstanding the*

difference of price in the carriage. This is accounted for by the fact, that in such a country as ours the habit of teaming cannot be broken up, and because the animals used in the draught must be kept, and can be used for transportation, when not needed for other purposes, at a small expense in addition to that required to keep them unemployed at home. But if the communication were extended across to the Connecticut, there would, probably, be sufficient inducement to go first to the river, and then across from the point where the artificial mode between that river and Concord would commence; it being an established axiom, that short routes, whether by canals or rail-roads, never can be profitable, while those of long extent may be. Near to the end of an artificial way, the income from carrying is next to nothing; for example, between Boston and Billerica, (to which, through Medford and Woburn, the canal is made,) a distance of eighteen miles, all the carrying done does not amount to two hundred dollars a year, in tolls. To apply these suggestions to the proposed rail-road to Lowell; can it be expected that the stages which run from Boston, through Lowell, to the north and west, will all stop at Lowell, and be there left by the passengers, and the rail-road transportation assumed? This is a point on which the Remonstrants ought not, perhaps, to offer an opinion, but the projectors will possibly find, that stage owners will carry passengers between Boston and Lowell *gratis*, rather than lose the carrying north and west of that place. The competition is such now, that a passenger is carried to Concord for \$1,00, to Hanover for \$2,00. The Remonstrants state a fact within their knowledge, which they think, in principle, may operate elsewhere. The distance from Concord to Salisbury is fifteen miles; teamsters will bring and carry from Salisbury to Concord, a ton weight for \$3,00, and from Concord to Boston, which is seventy-two miles, at 4,50 in addition for the ton, making \$7,50; and will thus make the land carriage preferable.

It is a circumstance not generally known, but of which these Remonstrants have costly knowledge, that the barter payment made by those who buy in the seaport to sell in the interior, brings down the cash value of transportation on wagons to an average with that required for transportation by artificial ways, though the former far exceeds the latter, *nominally*.

The Remonstrants; therefore, respectfully insist,

First, that there is no such exigency as will warrant the granting of the prayer for a rail-road to and from Lowell.

Secondly, that, if that prayer be granted, provision should be made as a condition for granting it, that the Remonstrants shall

be indemnified for the losses which will be thereby occasioned to them.

WILLIAM SULLIVAN, } *Committee of Directors of*
 JOSEPH COOLIDGE, } *Middlesex Canal, to this*
 GEORGE HALLETT, } *purpose duly authorized.*
Boston, February 12, 1830.

HOUSE OF REPRESENTATIVES, Feb. 13, 1830.

Committed to Committee on Rail-ways and Canals.

Sent up for concurrence.

P. W. WARREN, *Clerk.*

IN SENATE, February 16, 1830.

Concurred.

PAUL WILLARD, *Clerk.*

LETTER OF THE AGENT TO HON. JEREMIAH MASON.

Boston, November 25, 1842.

HON. JEREMIAH MASON,

Sir, — I send you the book in which are recorded the deeds of land owned by the proprietors of the Middlesex Canal — likewise the record books of the proprietors and directors — a copy of a petition to the Court of General Sessions, and appraisal by the Court's committee, of the damages for lands taken under the act of incorporation — together with plans of Concord river, from Sudbury to Lowell — all of which I will fully explain hereafter. The canal, from the Concord river at Billerica, to the Merrimac, is five and a quarter miles in length; and from the Concord, at Billerica, to tide-water, at Charlestown, it is twenty-two miles — making its whole length twenty-seven and one quarter miles. The Concord river, at Billerica, is one hundred and two feet above wharf level at Charlestown. The descent in the canal (by locks) from the summit level to the upper locks, at Woburn, is sixteen feet, or thereabouts, leaving the fall, from Woburn to Charlestown, eighty-six feet. The distance from the Boston side of Charles River Bridge to the lock spoken of in Woburn, is about ten miles, and two miles less to Mount Benedict, in Charlestown; the said hill being about 80 feet above wharf level. All this shows that the canal is admirably well calculated for supplying, by a reservoir at the Mount aforesaid, the city of Boston and the town of Charlestown with water. There are some questions, whether such a change of purpose of the canal can

be effected without extraordinary and new powers be obtained from the Legislature. In 1793, they granted the rights contained in the present charter, one of which is, to take land (when it could not be purchased in fee) for a navigable canal; and some lands were so taken, the damages adjusted and paid for, according to forms herewith sent you. You will see most of the lands were purchased by deeds of warrantee and fee. Now, it is a question whether the Legislature, in reality, possesses authority to grant the proprietors of the present canal a right to use the same for any other public purpose, without new conditions with respect to the payment of the lands, not held in fee. Have they power to discontinue it as a navigable canal, and allow it to be used as a canal for the purpose of supplying water to the city of Boston and Charlestown, provided no more water is taken from Concord river than the canal now draws through the present gates? Could they pass an act authorizing the proprietors to lay iron pipes from Woburn to Boston, to discontinue a part of the present canal used for navigable purposes, and to permit the proprietors to use the land over which the canal now lies, for the purpose of laying down iron pipes, necessary for conducting the required quantity of water, and for passing to and over the same for repairs, &c. I think it can be clearly shown that the owners of mills on the Concord river, and situated below the dam at Billerica mills, will be greatly benefitted by the change. According to the estimates of the best engineers, the quantity of water required to keep up the levels of a canal forty feet in width and fifteen miles in length, would be about thirteen millions of gallons per day. Besides the above, there is the quantity lost by lockage, which amounts to fifty thousand gallons every time a lock is discharged at the outlet at Charlestown, Medford, or Chelmsford; and, at the latter place, treble the above quantity to lock up a boat from the Merrimac to the level of the canal. Now this would all be saved, and, in addition, the levels in that part of the canal from Billerica to Woburn could be reduced about eight inches, and thereby prevent water from escaping over the waste-weirs, which would likewise effect a great saving of water. The quantity required for a full supply, (to the places named,) for the usual mechanical and domestic purposes, would not, probably, exceed one half of that saved by the proposed change. It seems to be the opinion of some of the directors, that the Legislature could grant the use of the waters of the canal for any other purposes, (not defined,) on condition that the present gates should not be enlarged, or more water be taken than has heretofore been drawn from the Concord river. In that case, it would be optional to use it for an aqueduct, or for any other

purpose, which hereafter may be considered as most beneficial to the proprietors. I am at your service for any further explanations.

With respect, your obedient servant,

CALEB EDDY.

OPINION OF HON. JEREMIAH MASON, TO CALEB EDDY, AGENT OF
THE MIDDLESEX CANAL.

The proprietors of the Middlesex Canal are desirous of terminating or discontinuing the use of their canal, as a means of transportation, and of applying the water now used in the canal, to the supplying the city of Boston with wholesome water. I am requested to consider and give an opinion on the legal questions supposed to be involved in the contemplated project.

This corporation was created by an act of the Legislature, passed the 22d of June, 1793. The objects and powers of the corporation are inartificially and ill-defined. From the various parts of the act, it may, however, be inferred, with sufficient certainty, that the object was to authorize the building of a canal from Merrimac to Medford river, for the purpose of facilitating transportation, and that the intention was to confer on the corporation all powers necessary for effecting that object. No other object or use of the canal is intimated by this act. Power is given to take water, and the lands of individuals, necessary for the canal, making due compensation for all damages. The corporation is also authorized to purchase and hold 'so much land and real estate as may be necessary for the purposes of the aforesaid act, not exceeding in value five thousand pounds.'

By an additional act of the 28th of February, 1795, it is provided, that the property of the said proprietors, in said canal, and in any other canal connected therewith, which they shall effect pursuant to any authority of the government, and all real estate, of which said corporation shall be seized, shall be divided into eight hundred shares. This act further provides, that the corporation may receive and hold real estate, appendant to the same canal, and for the purpose of facilitating the business of the same, to the value of thirty thousand pounds, over and above the value of the canal, simply considered. The proprietors are also authorized to render the waters of Concord river boatable, as far as Sudbury Causeway, &c., and to open any canal at any place in said county of Middlesex, that may be necessary to connect said Concord river with said Middlesex canal; and to extend said canal from Medford to the waters of the town of Boston or Charles river. By an act of 25th June, 1798, power is given to said corporation to purchase and hold any mill seats on waters

connected with said canal, and lands to accommodate the same, and thereon to erect mills.

The lands used for the canal, except a small portion thereof, were acquired by voluntary conveyances, for which a full and ample compensation is said to have been paid. Most of the conveyances describe the lands by metes and bounds, and convey the same to the corporation in fee simple, absolute and unqualified. Such is the case with one hundred and twenty deeds which I have inspected. Sixteen recite that the purpose of the conveyance is for the building the canal, to have and to hold to the use and behoof of the proprietors forever. Thirty-eight limit the use more strictly for the purpose of the canal.

The parcels of land taken by the corporation, by virtue of the power given by the act of incorporation, were duly appraised and paid for. The canal was built at great expense, and completed in 1804, and the tolls received by the proprietors, have not exceeded one per cent. per annum on the capital expended. And the rail-roads, granted by the Legislature, from Boston to Lowell, running near to, and parallel with, the canal, and thence continued to Nashua, have so diverted the transportation from the canal, that the tolls will not, in future, be sufficient to maintain it in repair. The water used for the canal is taken from Concord river. The desire of the proprietors is, wholly to discontinue the canal from Concord river, at Billerica, to Merrimac river, about five and one fourth miles, and to bring the water from Billerica in the present canal, to near Horn pond, in Woburn, about twelve miles, and thence, in iron pipes, under ground, to a reservoir, to be built on some suitable height, on the north side of Charles river, and thence, by like pipes, to Charlestown and Boston. The water requisite for the contemplated use will be much less than is now used in the canal. The corporation has, in accordance with the powers conferred by the aforesaid acts, acquired, and now owns, certain mills, lands, and water privileges, of considerable value.

The first question that occurs in considering this case is, as to the right of the corporation to discontinue the canal as a means of transportation. This is the only use of the canal contemplated and provided for in the act of incorporation. It constitutes the consideration, on the part of the corporation, for which all its powers were granted. It is quite certain, that the corporation cannot lawfully discontinue the present use of the canal, or any part of it, and apply the water to another use, without authority from the Legislature therefor. By so doing, the corporation would forfeit all its rights. A corporation, created for public purposes, by neglect to perform the duties, prescribed and required

by its charter, thereby forfeits its charter. It is a familiar doctrine that, for either nonuse, or misuse, of their franchises, the charters of corporations may, on due proceedings, had in a judicial court ascertaining the same, be repealed and vacated. It always depends on the discretion of government, whether, or not, to institute such proceedings.

It is equally certain, as I think, that, with the consent, and by authority, of the Legislature, the corporation may discontinue the use of the canal, for the purposes of transportation, without incurring any forfeiture. The maintaining the canal for transportation is a duty which the corporation owes the public, or the State, and the Legislature, representing and acting for the State, may, for reasons or considerations, deemed satisfactory, release and discharge the corporation from this duty. If the canal has become useless, as a means of transportation, or so nearly so, that the tolls received for transportation will not indemnify the expense of necessary repairs, it is probable the Legislature would, on application, deem this a good and sufficient cause for assenting to release the corporation from such duty. This would seem to be the more probable, as the Legislature, by authorizing the building of the rail-roads, has rendered the canal thus useless to the public, and unprofitable to the proprietors.

Admitting that it was competent for the Legislature to authorize the building of the rail-roads, directly tending to the ruin of the canal, there is certainly a strong ground for contending, on the principles of natural justice, as well as on the Constitution, that the provision ought to have been made for indemnifying the proprietors of the canal for their loss, thus caused by the act of the Legislature. This, certainly, constitutes a sufficient reason why the Legislature should not compel the proprietors to maintain the canal at their individual expense, on penalty of forfeiture of all the other property of the corporation, which would be the case on the repeal of the charter.

Another question, and of more difficulty, is, whether it be competent for the Legislature, on discontinuing the canal, for the use of transportation, to authorize the proprietors to use that part of it south of Concord river, with its waters, for the purpose of supplying the city of Boston with wholesome water. I have no doubt that the supplying of the inhabitants of the city of Boston with good water, necessary for their health, and in sufficient abundance to furnish security against fire, constitutes an exigency justifying the taking of private property for public uses. The Legislature has often exercised the right of eminent domain, by vesting this power in corporations, on much less urgent occasions of public necessity. There seems, therefore, to be no rea-

sonable ground of doubt, that it is competent for the Legislature, on the discontinuance of the canal, for its present prescribed use for transportation, to authorize and empower the proprietors to apply and appropriate the canal, and its waters, to the different use now contemplated. But a further question is, whether the canal and its waters may, by authority of the Legislature, be thus diverted from the use, prescribed by the act of incorporation, to another and entirely different public use, without provision for compensating the land-owners, whose land has been taken, and all persons interested in Concord river, for damages caused by the canal to be kept up for the new use. It is apparent from the statement of the case, that neither the land-owners, nor those interested in the waters of Concord river, can sustain any additional or increased damages from the intended use of the canal. The quantity of water required for the contemplated purpose, will be much less than what is now taken and used, by authority of the act of incorporation, and the intended use of the canal, for twelve miles, intended to be kept open, can, in no way, occasion any increased damage to the land-owners — and, for the remaining part, through which the water is intended to be conveyed under-ground, it is obvious that the damage to the land-owners must be greatly diminished. As the full value of the lands taken has been paid, and all damages satisfied, there seems to be no foundation in natural justice and equity for a claim for further compensation. Still, however, it may be contended that the land and water taken were solely for one single specified public use, and that, when that use is discontinued, or in any way ended, the property, taken for such use, reverts to the former owners, discharged of the use, as is the case with lands taken for highways, when discontinued, and that, applying the property thus taken to a new and different use, is tantamount to taking it again for a public use, which cannot, according to the provision of the Constitution, be done, without making compensation; and that, when land is taken for a highway, or turnpike road, the fee still remains in the owners, subject only to the prescribed use, and when that use ends, the land is disencumbered. It is difficult to give a satisfactory answer to this objection. The taking private property for public use, by right of eminent domain, rests on the public exigency or necessity, and is limited thereby. Private property cannot be lawfully taken for all public uses, and appropriated generally to all such public uses as the exigences of the State may, at any future time, render necessary. But the specific use, for which it is taken, must be defined, and the necessity therefor be declared. There would seem to be no doubt of the right of modifying, or altering, the man-

ner of exercising the public use, while the object to be retained is the same, as when land should be taken for the necessary ways and wharfage to a public ferry, it may be applied to a bridge for accommodating the same public travel which was done less perfectly by the ferry. In this case the object to be attained by the bridge is the same as that of the ferry. The mill acts, in this State, authorizing mill-owners to flow lands, making compensation therefor, which rest on the right of eminent domain, have always been supposed to confer on the mill-owners the right to change the use of the water from mills of one kind to those of another, of ever so different a nature, as, from the use of a saw mill to that of a cotton mill. In this case, however, the use of the water is still for a mill, and the power thus to flow other lands is conferred on the owners of all water mills, for whatever use they may be applied.

I find no judicial decision or discussion on the power of the Legislature to change the use of private property, taken for one specified public use to another and different use. In the absence of all authority, I cannot give a decided opinion on this point. I think it most probable, that the Legislature will, if applied to, give the proprietors the right of using the canal for the intended purpose without making any new or further compensation to the land-owners, whose lands have been taken under the act of incorporation, or to those interested in the waters of Concord river; and I am inclined to the opinion that the Supreme Court will sustain such proceedings. But I do not think this matter is of very great importance in a practical point of view. Much the largest portion of the lands, used for the canal, was acquired by the corporation, by voluntary conveyances. The first and greatly the largest class of deeds, as mentioned in the statement, convey the land in fee simple, absolute, without restriction or limitation to any special use. The lands thus conveyed may doubtless be applied by the corporation to the contemplated use. The second class of deeds contains recitals that the lands are conveyed for the purpose of building the canal, but limit the same to the use of the proprietors forever. I am of opinion, that such recital does not create a condition, for the breach of which the land may be forfeited, and therefore that the right of the corporation in those lands is the same as in those of the first class. As to the third, although the limitations are somewhat more definite to the use of the canal, yet I am inclined to the opinion that the corporation, by using the lands for the intended purpose, would not thereby incur a forfeiture, except as to two deeds, in which the limitations are more strict and precise.

The claim of compensation will therefore be mostly confined

to the lands which were taken, and compensation therefor made, under the act of incorporation, the quantity of which is comparatively small. The importance of the apprehended claim of compensation is further lessened, by the consideration that the water at or near Horn pond is intended to be taken out of the canal, and conveyed in pipes under ground, and probably on a more direct and shorter line to the reservoir than the track of the canal. The passing the water in this manner under ground could cause but trivial damage to any land-owner.

Power must be obtained from the Legislature to take lands necessary for the water-works, including the place of the location, of the reservoir. In such grant may be included, in general terms, the right of taking any lands, in the track of the canal, that may be claimed to be owned by individuals, which would protect the corporation against vexatious suits. The act of the Legislature, granting the necessary powers for bringing the water into the city of Boston, must, probably, in some way make provision for securing to the inhabitants the use of it, on reasonable terms. Should this be done, by reserving to the city of Boston the right of purchasing from the proprietors all their property and interest in the water-works, it will be necessary to state in the act the sum at which the canal, in its present state, shall be estimated. This may require the mature consideration of the proprietors.

J. MASON.

Boston, Dec. 21, 1842.

CHEMICAL EXAMINATIONS OF THE CONCORD RIVER WATER.

Boston, February 29, 1841.

CALEB EDDY, Esq.,

Dear Sir, — By your request, I visited several places on the Middlesex Canal, in your company, on the 9th instant, and selected three samples of the water which flows along that canal. The water was put into glass-ground stoppered gallon bottles, and the stopples were secured by sheet India-rubber, so as to prevent any escape of gaseous matter, if any was present. Below I present my report of the composition of these waters :

Specimen marked A, was taken from Concord river at the Billerica mills.

One gallon of this water contains 2.4 grains of vegetable and mineral matters derived from the soil; 1.2 of this matter is of vegetable origin, and 1.2 consists of mineral matter.

The organic matter consists of apocrenic and humic acids, with a little phosphoric acid. These acids are combined in the water with lime, alumina, per oxide of iron, and traces of magnesia, potash, and ammonia. There is also a small quantity of silica dissolved in the water in the state of silicate of potash.

The mineral ingredients, as above noted, constitute 1.2 grains to the gallon of the water. All of these ingredients are evidently derived from the soil through which the water flows. The yellowish color, observed in the water, is derived from the presence of the apocrenic and humic acids which are combined with the above-mentioned bases, so as to form perfectly neutral compounds. The water contains but little gaseous matter, which is chiefly atmospheric air, with a little carbonic acid gas. The water is perfectly soft and suitable for washing, and is much purer than any well-water of Boston that I have analyzed.

Specimen B was obtained from the canal near the Horn pond Hotel, and was taken from below the ice, which was at that time about one inch thick. This water was put up in the same manner as that before mentioned. A gallon of this water contains 3.4 grains of matters dissolved, such as mineral and vegetable substances derived from the soil. The mineral matters in one gallon weigh 1 grain, and they are combined with the vegetable acids, as in water A. There is also in this water a small proportion of sulphate of lime, or gypsum and manganese, and a trace of muriate of soda (salt.) The water contains a small proportion of carbonic acid gas and atmospheric air. It is soft and suitable for washing, and contains less mineral matter than water A, as will be seen by referring above, and it is probable that the water deposits a portion of its mineral ingredients, as it flows so gently along the canal, from the level at Billerica mills to Horn pond. By reference to my former analysis, you will be able to institute a comparison of the canal water with the waters of other available localities, and will perceive that the canal water is vastly purer than the well water of this city. It may be thought advisable to examine the waters of the twelve different wards of Boston, taking specimens of those which are considered the best. From what I already know of Boston waters, I am of opinion that the canal water would be preferred to the best well water of the city; for, although it is more colored than well water, it still contains less foreign matter. It is quite

probable that the canal water is more highly colored with the soluble matters from decayed plants in the winter than in the summer months. If, therefore, you should deem it needful, the waters can be again analyzed at that season.

Respectfully, your obedient servant,

CHARLES T. JACKSON.

Lowell, March 2, 1843.

TO CALEB EDDY, ESQ., BOSTON:

Sir,—I have examined the water of Concord river, which you brought me, on the 25th of February last. The following are the results:

One gallon affords solid matter,	4.811 grains.
This is composed of vegetable matter,	1.261
“ “ mineral “	3.550
	<hr/>
	4.811
The mineral matter is composed of muriates	
of lime, and iron, and common salt,	1.479
Sulphate of lime; and iron, and lime and si-	
lex, which were combined with vegetable	
matter,	2.071
	<hr/>
	3.550

Both the vegetable and mineral matters are common in well water, and in that of ponds or lakes and rivers. The salt and vegetable matter are the same as found in rain water.

With regard, I am your obedient servant,

SAMUEL L. DANA.

Roxbury Laboratory, 17th March, 1843.

Dear Sir,—I finished the analysis of the specimen of water you sent me to-day, and give you below the results. It is remarkably pure; more so, I think, than any colored water I have examined before.

One hundred thousand parts of the water contain, of saline and organic foreign matters, only seven and $\frac{830}{1000}$ of a grain.

Common salt, with muriate of magnesia, and traces of	
chloride of potassium,	0.57
Sulphate of soda,	0.27
Crenate of lime, (perfectly dry,)	2.99

Apocrenic acid, mucous matter, carbonic acid, and ammonia,	3.16
Alumina and oxide of iron, with silica from the crenic and apocrenic acid,	0.84
	<hr/>
	7.83

The standard gallon of this country, containing 58460 grains of distilled water, would, when filled with this water, include 4 $\frac{575}{1000}$ grains of foreign substances. These, in proportions, are,

Common salt, with muriate of magnesia, and traces of chloride of potassium,	0.333
Sulphate of soda,	0.157
Chromate of lime,	1.747
Apocrenic acid, mucous matter, carbonic acid, ammonia, Alumina, oxide of iron and silica, combined with the apocrenic and crenic acids,	1.847
	0.491
	<hr/>
	4.575

I found the crenic acid to be in excess over the quantity required to form a neutral compound with the lime and other bases present; while the carbonic acid is in very small proportion. The turbidity which soap produces with the water is doubtless due to this acid action of the crenic salts.

I consider this water as unobjectionable for manufacturing purposes generally, and that it is more pure than ordinary stream or pond water. In preparing pigments of light shades its organic constituents would impair their colors.

With high regard, truly yours,
A. A. HAYES.

Boston, March 20, 1843.

Dear Sir, — I send you Mr. A. A. Hayes's report on the analysis of the water of Concord river, which he has made at my request, without knowing whence the water came, or for what purpose it was required to be analyzed. He was also unacquainted with the results of the analysis by Dr. Dana and myself. You will perceive that the several analyses agree in all essential particulars, and all go to prove that there is no injurious matter in the water. The difference in the respective analyses is owing to the different gallons taken for the standard measure. I took the British imperial gallon, of 70,000 grains, for mine, and it is probable that Dr. Dana took the same, for his propor-

tions and mine agree. Mr. Hayes adopts the American gallon, of 58,460 grains: hence his proportions are less than we obtained. The quality of the water evidently undergoes but little change from year to year, as indicated by results of our researches.

Mr. Hayes refers to the manufacture of white lead, probably, when he speaks of pigments, supposing that some manufacturer's question was to be decided by the analysis. He is decidedly of opinion that the water is better than any well-water of Boston, and that it will answer perfectly for ordinary uses in the supplying of Boston with soft water. Its color may be removed in a great measure, in the settling pond, by putting in a few barrels of chalk, or by filtering it through a bed of chalk, and charcoal, and gravel.

Yours, truly,

C. T. JACKSON.

Cambridge, Dec. 1st, 1843.

CALEB EDDY, Esq.,

Dear Sir:—I have examined the water received from you a few weeks since, taken from Concord river. I find it soft, and freer from foreign substances than the water from many springs and wells in the city and vicinity. The slight yellow color of this water arises from vegetable matter; but this, I found, in a great measure, disappeared after a few days' repose. This slight tinge can be no objection to the use of this water, and was, probably, more apparent in the specimen I examined than it would be in a portion taken from the river in the winter; the quantity of foreign matters too in a gallon would be greatest in summer, from the greater concentration of the water by evaporation. The foreign substances in this water are those usually met with in the water of ponds and rivers, in this case imparting no unwholesome or injurious property.

I consider this a very pure water, and applicable to all domestic and other uses.

By evaporation of a measured quantity, I found the foreign matters contained in one gallon to be but 4.362 grains, consisting of salts of lime, soda, iron, and potash, with alumina, carbonic acid, crenic acid, and silica.

Common salt, muriate of magnesia, and potassa,	0.286
Sulphate of soda, iron lime,	0.148
Lime, crenic acid,	1.674
Lime, apocrenic acid, carbonic acid, vegetable matter,	1.865
Alumina, oxide of iron, silica,	0.389

Very respectfully, yours, &c.,

4.362

J. W. WEBSTER.

Chemical Analysis of two Specimens of Water from the Fairmount Water Works, in Philadelphia, by Charles T. Jackson, 27 Somerset street, Boston, Dec. 25, 1841.

Specimen marked A, taken from the river above the works. One pint of this water, = 8750 grs. weight, was carefully evaporated to small bulk in a Bohemian Glass retort, and the evaporation was finished without heat in a dessicated atmosphere under glass in platina. The dry residue weighed two grains.

The organic matter being burnt off, there remained 1·7 grains of mineral matter, of a light brown color.

The organic matter is mostly of vegetable origin, and weighs 0·3 grains.

The mineral matter, analyzed, yielded as follows:

Silica,	= 0·7 gr.
Alumina, P. oxide of iron and manganese,	0·2 gr.
Carbonate of lime,	0·4 gr.
Magnesia,	0·2 gr.
	<hr/>
	1·5 grs.
Water and loss,	0·2 grs.
	<hr/>
	1·7 grs.

The organic matter was then analyzed, another pint of the water being very carefully evaporated to dryness in a dessicated atmosphere, in a thin platina bowl, and the weight of the whole matter in the pint of water was found to be as before, 2 grains.

The organic matter being dissolved out from this matter by means of carbon ammonia, left 1·7 grs. of earthy matter, which, on being ignited, was reduced to 1·6 grains; 0·1 gr. of water of composition being expelled by a red heat. The organic matters were determined by tests to consist of crenic acid, apocrenic acid, and extract of humus — and are organic matters which the water derives from the soil over which it flows in its course.

Analysis of half gallon of water B.

Water B was taken from the reservoir whence the water is distributed to the city of Philadelphia. This is much clearer from sediment than water A, and it was necessary to operate on a much larger quantity in order to determine the precise nature and proportions of the foreign matters which it contains. I

therefore took four standard pints of this water, and evaporated it carefully in a Bohemian Glass Retort, until its bulk was sufficiently reduced for transference into a platina capsule, in which the evaporation was finished, without heat, by aid of an absolutely dry atmosphere, over concentrated sulphuric acid.

When perfectly dry, the residual matter had a yellow brown color, and weighed 5.15 grs.

From the retort I removed by acid and separated 1.00 grs. of carb. lime.

6.15 grs. to 4 p'ts wat.

From the 5.15 grs. of brown matter obtained, I separated the organic matter, and then removed 3.8 grs. of mineral matter—1.35 grs. of organic matter being dissolved by a hot solution of carbonate of ammonia with which it was digested.

The organic matters thus dissolved I separated by proper processes, and ascertained them to consist of

Crenic acid,	= 0.65 gr.
Apocrenic acid,	= 0.20 gr.
Humic acid and extract,	= 0.50 gr.
	1.35 gr.

The 3.8 grs. of mineral matter consisted of

Silica,	2.10 gr.
Alumina and oxide of iron,	0.20 gr.
Carb. lime, magnesia traces,	1.50 gr.
	3.80
Carb. lime from retort,	1.00
	4.80 mineral

matters in one-half gallon of the water.

The water also contains carbonic acid gas in sufficient quantity to hold 2 grs. of carbonate of lime in solution, in one gallon of the water, the lime being in the water in the state of bicarbonate of lime.

By comparing the above analyses with those of the Lake, River, and Canal waters which I analyzed for you last year, you will be able to draw your own conclusions as to the comparative purity of the waters in question. My own opinion is, that the Lake waters are much purer than any River waters, and the

Lakes are Nature's great Reservoirs, where the foreign matters are more perfectly separated from water than in any of our artificial ponds.

P. S. Water A contains 13·6 grs. of mineral matter, and
2·4 grs. of organic vegetable matter.

To one gallon . . . 16·0 grs. in all.

Water B contains in one gallon,

Mineral matter,	. . . . .	9·6 grs.
Organic vegetable matter,	. . . . .	2·7 grs.
		<hr/>
		12·3 gr. in all.

CHARLES T. JACKSON.

Mr. Chilton's Report on the Examination of the Croton River Water, extracted from Major Douglass's Report of 1833.

1. The application of reagents to the water showed the absence of sulphuric acids and sulphates; and the presence of lime, magnesia, carbonic acid, muriatic acid, and vegetable matter.

2. By evaporation to dryness, resolution of soluble matter, and filtering, a residuum was obtained, which dissolved in dilute muriatic acid with effervescence, except a portion of vegetable matter.

3. The watery solution of soluble matter (in No. 2.) contained muriate of magnesia and vegetable extract, without lime.

4. The muriate solution (of No. 2,) which, in its formation, was attended with effervescence, contained both lime and magnesia; the matter therefrom must have been the carbonates of these earths.

From these results, we are authorized to consider muriate of magnesia, carbonate of lime, carbonate of magnesia, and vegetable matter, as the only ingredients of the water.

5. A half gallon, principally from the bottle marked ⊕, yielded by evaporation, 2·333 grains residuum moderately dried, consisting of

Vegetable matter,	. . . . .	0·133
Carbonates of lime and magnesia,	. . . . .	1·200
Muriate of magnesia,	. . . . .	1·000
		<hr/>
		2·333 grains.

6. No. 1 and 2, a quart of each yielded 1·3 grains, which is 2·6 grains of dry residuum for the half gallon, consisting of

Vegetable matter,	0·125
Carbonates of lime and magnesia,	1·375
Muriate of magnesia,	1·000

2·500 grains.

7. Six pints, from the bottles, yielded only 2·1 grains of dry matter, the vegetable matter reduced to charcoal and burnt off; this gives to the half gallon 1·4 grains. The average of these three separate results is, for the half gallon 2·08 grains, or for the gallon 4·16 grains.

PROPOSED FORM FOR AN ACT FOR A WATER WORKS' COMPANY.

COMMONWEALTH OF MASSACHUSETTS.

In the year of our Lord one thousand eight hundred and forty-four.

An Act to incorporate the Middlesex Water Company.
Be it enacted, &c.

SEC. 1. Abbot Lawrence, and all the other proprietors of the Middlesex Canal and their associates and successors, are hereby made a corporation by the name of the Middlesex Water Company, with all the powers and privileges, and subject to all the duties, liabilities, and provisions contained in the 44th chapter of the Revised Statutes, (not incompatible with the acts appurtenant and of even date herewith,) passed on the 4th day of November, 1835.

SEC. 2. The capital stock of said Company shall consist of ten thousand shares, and no assessments shall be laid thereon of a greater amount in the whole than one hundred dollars on each share.

SEC. 3. The said Corporation may purchase, take, and hold in fee simple, or for any less estate, any lands necessary for the objects of this act, and for the convenient management of the concerns of said Company, not exceeding in value the sum of two hundred thousand dollars, may take and hold any ponds, or any lands covered with water, or the Middlesex Canal, extending from Concord river in Billerica to Horn pond in Woburn, or other place situated northerly or northeasterly from Charles river, for the purpose of conducting water from the said Concord river through the towns of Charlestown or East Cambridge, or other conve-

nient part of the county of Middlesex, and into and through the city of Boston, or towns in the vicinity thereof; and to this end may take and hold any lands necessary for laying aqueducts, forming reservoirs, and any flats flowed by tide waters, which may be required to carry the objects of this act into effect, and may erect such wharves and other structures as such corporation may find expedient; and establish such steam-engines, and other machinery, as may be necessary for the purposes aforesaid, and if the proprietors of lands which the said corporation may take at or near ponds or elsewhere, for the purpose of laying pipes or conductors of water, constructing reservoirs, wharves or other buildings, or for protection of the sources from whence water is to be taken or drawn by said Company, do not agree with said Company in the price to be paid therefor, any such proprietor may have the damages assessed in the same manner as is provided in the 116th chapter of the Revised Statutes, passed the 4th day of November in the year one thousand eight hundred and thirty-five; and the said Corporation, in all cases where it does not acquire title to any land by voluntary conveyance, shall cause a certificate, describing the land so taken, to be signed by the President of said Company, and recorded in the registry of deeds of the county in which the land lies.

SEC. 4. The said corporation is hereby authorized and empowered to lay its pipes or aqueducts, under or over or through any rail-road, canal, highway, river, or street, provided always, that the same be done in such manner as not to obstruct or impede the passing thereon; and said corporation may lay its pipes and aqueducts under or near or upon any bridge or causeway now erected across Charles river, and leading it into the city of Boston, and through the whole length of said causeway or bridge and its abutments; Provided, always, that the same be so done as not to impede or obstruct the convenient passing of said bridge or causeway, and provided also, that in laying said pipes and aqueducts, or in the use or repair thereof from time to time, no damage or injury shall be done to said bridge or causeway; and provided, further, that the pipes or aqueducts be so laid in Charles river as not to obstruct or impede the free passage of any vessel thereon.

SEC. 5. The said corporation in laying its pipes or aqueducts through the highways and streets of the towns of Charlestown, East Cambridge, and in the city of Boston, or elsewhere, and in repairing such pipes and aqueducts from time to time, shall not unnecessarily obstruct such highways and streets; and in every case of the removal of any earth or pavement in any such highway or street, the said corporation shall cause the earth to be replaced and the pavement to be laid anew, so that such high-

way or street shall be in as good condition as the same were in before such removal.

SEC. 6. In the laying and construction of the pipes or aqueducts which may be laid in the towns of Charlestown, East Cambridge, and in the city of Boston, or other towns adjoining, or in the vicinity of the said city, the same shall be so laid and constructed that water can be drawn therefrom for the extinguishment of fires, and to be used by the persons thereto authorized by the towns of Charlestown, East Cambridge, and by the city of Boston, and towns adjoining, or in the vicinity of the said city, respectively, and free access to the water in such pipes and aqueducts shall be had whenever the same shall be laid within the city of Boston, and within that part of the town of Charlestown, lying within, or eastwardly of the neck, so called; and the said town, and town of East Cambridge, and city, shall have the right at their own cost, respectively, to place fire-plugs and all proper and necessary fixtures therefor upon any pipes or aqueducts of said corporation, and at as many different places in the several highways and streets as the Selectmen of the said towns, and the Mayor and Aldermen of the said city shall deem needful for the purpose of drawing water for the extinguishment of any fires which may happen in said towns or city, Provided, that the said fire-plugs and fixtures shall not be used for the purpose of drawing water from said pipes for any other use than for the extinguishment of fires, and shall be so constructed as to prevent the water in the pipes from running to waste, and the said corporation shall not demand or receive any compensation for water taken for the extinguishment of fires as aforesaid.

SEC. 7. If any person shall wilfully and maliciously defile, corrupt, or make impure any waters used by said corporation as aforesaid, or destroy or injure any dam, pipe, aqueduct, machinery, or other property of said corporation, such person and all who shall aid or abet in such trespass, shall forfeit to the use of the said company for every such offence treble the amount of damages which shall appear on the trial to have been sustained thereby, and may further be punished by a fine not exceeding one thousand dollars, or may be imprisoned for a term not exceeding one year.

SEC. 8. The said corporation is hereby empowered to sell the privilege of using the water which may be conducted from the ponds or canal as aforesaid, to any corporation, person or persons, said contracts to continue for no longer term than three years, provided that no compensation shall be taken for the use thereof for the extinguishment of fires, as aforesaid; and the said corporation, first named, may make all reasonable rules and

regulations, as to the manner and the times in which said water may be taken and used.

SEC. 9. Whenever the said corporation shall have appropriated a part of the Middlesex Canal, or any pond or ponds, or any lands, which it may deem necessary and proper for carrying the purposes of this act into effect, no other corporation, person or persons, shall enter upon such canal, pond or ponds, or sources from which their waters are derived, or lands, for the purpose of conducting the waters in such canal, pond or ponds, or any streams connected therewith, into the city of Boston or towns of Charlestown or East Cambridge, or other towns aforesaid, nor draw the same out of said canal, pond or ponds for any purpose whatsoever; but such waters shall be and remain to and for the use of said corporation, so long as said corporation shall supply the city of Boston with water from said ponds according to the true intent and meaning of this act.

SEC. 10. The said corporation shall cause a true and faithful record of its proceedings, and just and accurate accounts, to be kept, which books and accounts shall be subject, at all times, to the inspection of any committee appointed by the General Court, or by a committee appointed by the City Council of Boston, and all officers and agents of said corporation shall be liable to examination on oath by either of said committees.

SEC. 11. The city of Boston shall have the right to subscribe [in common with others] for one third part of the shares in said corporation, or any less proportion thereof; and the said city may, at any time, purchase of the said corporation their franchise and all their personal and real property, by paying therefor such a sum as together with their receipts, will reimburse the whole amount expended, with an annual interest of ten per cent.; and from and after the execution and delivery of the conveyance and transfer aforesaid, the said city of Boston shall have all the right, and be subject to all the duties in this act expressed, as to said corporation, and especially as to continuing the supply of water to the towns of Charlestown and East Cambridge, and other towns aforesaid.

REMARKS, &c.

It is evident that the well-water of the city of Boston is constantly diminishing in quantity, and deteriorating in quality. That now obtained from rains amounts to little indeed, the city being so covered with buildings, paved yards, and streets, that the rain or top-water is prevented from passing into the earth, and is

carried into the ocean by gutters and drains. At present, there cannot be found one acre of land, by itself, within the city proper, that is not built upon; and all the back grounds have been reached and brought into use by courts and passage-ways. There can be many instances adduced, to show that the quantity is diminishing. A number of years ago, Mr. Ezra Trull sank, at great expense, a very large well, for a supply of water for his distillery in Merrimac street. This well, for some time, yielded an abundance, and could not be exhausted at the period when dug, by five or six large pumps constantly in motion by horse-power. At the present time, one of the same pumps will entirely drain it in a few hours. The wells of Mount Vernon Street have been lowered to the depth of ninety or one hundred feet — and the water in one, of about that depth, in the State House yard, is affected by the tide, and rises and falls with the same. There can be no great doubt that the proximity of all the wells of Boston to the ocean, is the cause of their being more or less impregnated with saline and other matters, injurious to health, entirely unfit for domestic use, and for steam-engines and manufacturing purposes generally. The under-ground sewers and drains of the city are innumerable, many having vaults and privies connected with them, the fluids from which are constantly percolating through veins of sand and gravel, and into wells. Doctor Jackson, in one of his scientific Tracts for the Diffusion of Useful Knowledge, says: 'How disgusting an effect would be produced, should we place before the eyes of the reader, examples of the most filthy water used in Boston, I cannot say. 'One specimen which I analyzed, and which gave three per cent. of animal and vegetable putrescent matter, evidently owed its impurities to the public sewers and drains; and strange as it may appear, it was at one time sought after as a mineral-water, and was publicly sold in Hawkins street, about sixteen years ago. It was then believed that water having such a remarkable fetid odor, and nauseous taste, could be no other than that of a sulphur spring; and consequently, it was thought to be medicinal. How many cures were effected by its virtues is not related, but its medicinal powers vanished with the discovery that the spring arose from a neighboring drain, and that the odor was no other than that arising from the putrefaction of vegetable and animal matter.' 'The water of the wells in Charlestown Navy Yard is also charged with salts, and it is said that our experienced officers decline using it on their long cruises, in our ships of war, on account of the prejudicial effects it exerts on the health of the men; and in lieu thereof, fill their tanks with purer water from the Middlesex Canal, or obtain supplies from some other port.'

And again he says: 'Water is one of the principal compon-

ents of the juices of plants and the blood of animals, and is absolutely necessary for the existence of those fluids, which form the circulating medium through which all the nutritive matter is conveyed to those various organs, and the fluids by which worn out parts are removed by excretion. The sap, or common juice of plants consists chiefly of this fluid; and the blood of man contains ninety per cent. of water. Plants as well as animals and man can bear the privation of food longer than they can that of water, which is absolutely necessary to their existence, as the vital air is to animals; and, like that, there is no substitute for it. It is also essential to the health of man that he should be supplied with pure and wholesome water, free from all deleterious salts and foreign matter of an injurious character. Salt water will neither quench thirst nor support life.'

'It is evident that the health of a whole community may be so affected by impurities in water drunk by them, as to give a peculiar morbid expression to their countenances, which causes the observant eye of a traveller to remark it, while he in vain endeavors to account for the phenomenon.'

'Who has not remarked the expression common in some of our cities, as in New York and Boston, which is called a 'care-worn and anxious expression.' This expression, I will venture to assert, is not so much the result of 'too much care,' as it is of abdominal disease, produced by the habitual and continued use of impure and unwholesome water, which has fixed upon us this morbid stamp. I do not know that the people of the cities in question, are subject to more care than those in other districts, but I do know they use every day, in many forms, a variety of noxious ingredients, which they pump up from these wells, dissolved in water, and which enters into every form of food and drink they use in their houses.'

Mr. F. B. Tower, of New York, in his work on the Croton water-works, says—'There can be no doubt that the chief cause of the excess of mortality in cities, over that of the country, is to be found in the impure water, with which the former are so generally supplied, and we may confidently predict, that, in consequence mainly of the introduction of the Croton river into the city of New York, no city in the world, of equal size, will surpass it in salubrity.'

The advantages which soft water possesses over hard, in the thousand economical purposes of life, are too obvious to need particular remark. The lime, contained in well-water, renders it inapplicable to the purposes of brewing, tanning, washing, bleaching, and many other processes in the arts and domestic economy; and we believe the calculation would not be found extravagant if we should say that, by the use of the Croton was

ter, \$100,000 annually will be saved to the inhabitants of New York, in the articles of soap and soda alone. When to this we add the increased comfort and health of the citizens, from its free external and internal use — the superior cleanliness of the streets, by the washing away all stagnant matters in the sinks and gutters, and the consequent purity of the atmosphere — the diminution of danger from fires, and the consequent reduction of rates of insurance, with other important advantages too numerous to detail — we shall not consider its introduction purchased at too dear a rate, even were the expenses attending it increased to double the actual amount. We need not attempt to specify, in detail, the benefits which are likely to accrue to the city of New York from the introduction of an abundance of pure water. Its value is not to be estimated by dollars and cents; though it might easily be shown that it already saves to the citizens a sum far exceeding the annual interest on its cost.

And who knows better than the ladies the value of pure soft water? Mrs. Hale, in her excellent manual, 'The good Housekeeper,' remarks, that hard water always leaves a mineral matter on the skin, when we use it in washing, which renders the hands and face rough and liable to chaf. Does not this water, if we drink it, likewise corrode and injure the fine membranes of the stomach? The Boston people, who constantly use hard water for all purposes of cookery and drink, certainly have bad complexions, sallow, dry, and hard looking; and complaints of the stomach, or dyspepsy, are very common among them.

From the report of the water commissioners of New York, March 4, 1835, it is stated, 'that the public health requires it. The effect of cleanliness in cities, in preventing or staying epidemics or pestilences, is so far proverbial as to need no argument in its support.'

'Bad air and bad water are leading causes of sickness in all populous towns. With a river at our command, the causes of the noxious vapors which our gutters now supply, and which contaminate our air, will be removed. And what evil consequences may not be looked for from the water our laboring and poorer classes drink, when, in the language of the Lyceum of Natural History, used in 1832, 'with our (then) present population there is put into the ground about one hundred tons of excrement in twenty-four hours. In these deposits we may find all the ingredients detected by analysis, and which destroy the purity of our waters;' and what good, in point of health, may we not expect from the free use of pure water by our citizens, instead of an article impregnated with such vile and disgusting ingredients? The public safety requires it.'

‘By a report furnished to the committee, by the chief engineer and the water purveyor, it appears that there have been 110 destructive fires during the last year, and about 220 false alarms. During the last thirteen months the insurance companies have paid losses by fire to the amount of \$910,931. During the month of January twenty-four fires destroyed thirty-seven buildings, and \$177,150 worth of property. The losses by fire the last year are equal to one third the whole estimated expense of bringing the water from the Croton, and delivering it at our doors.’

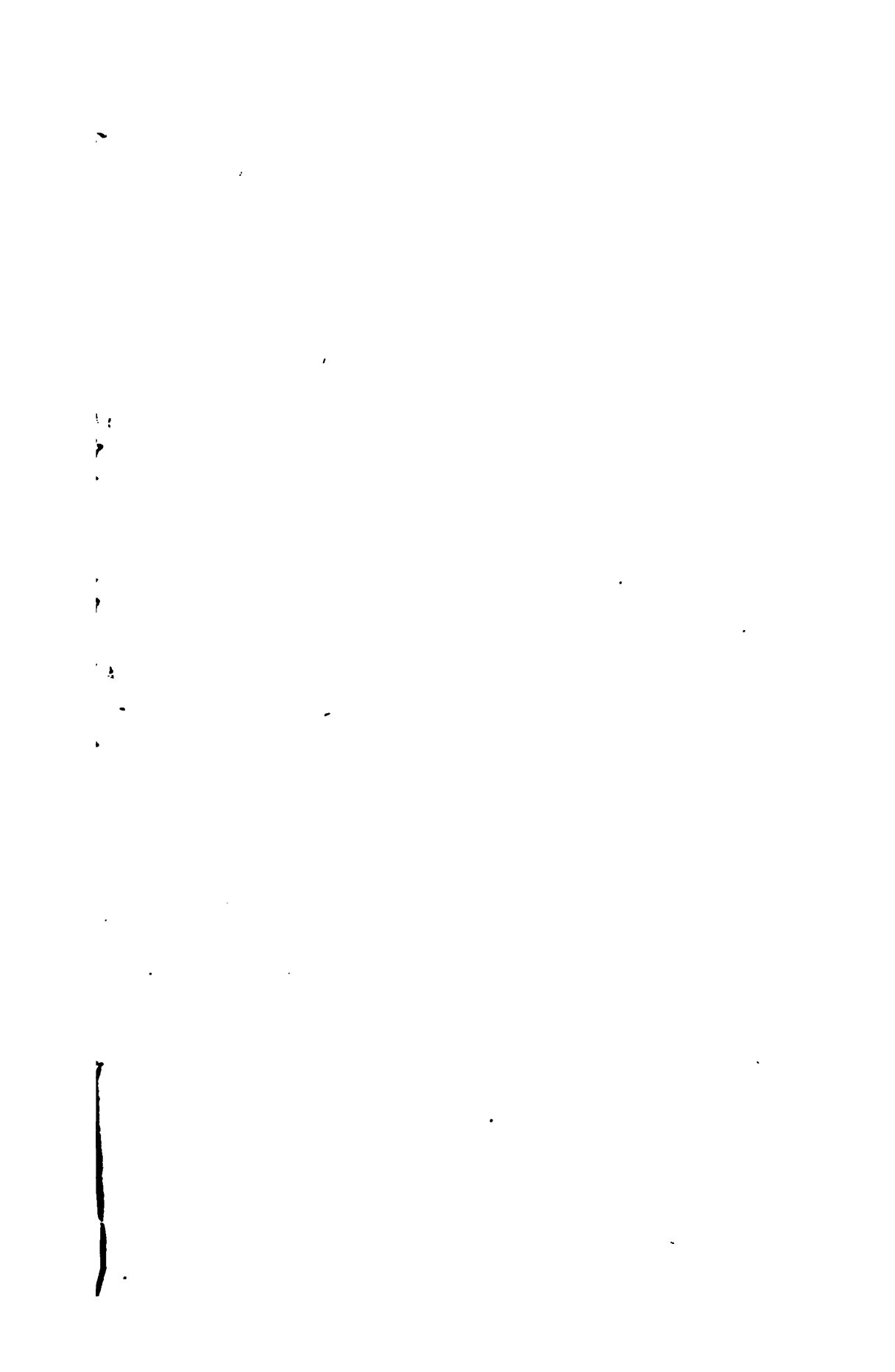
‘The duty the authorities owe to the people, and which the people owe to themselves, to advance all those improvements which will tend to lighten the public burdens, require that this great work be done. The savings in the fire department, in wells, pumps, cisterns, and losses by fire, would amount to the sum of more than one million of dollars per annum. Such facts strike with astonishment, and lead to the inquiry, How have we slept so long under this reign of destruction, with the means in our hands of overthrowing its empire? Such losses would pay for the work in little more than five years, and the reductions of the premiums are not taken into the account.’

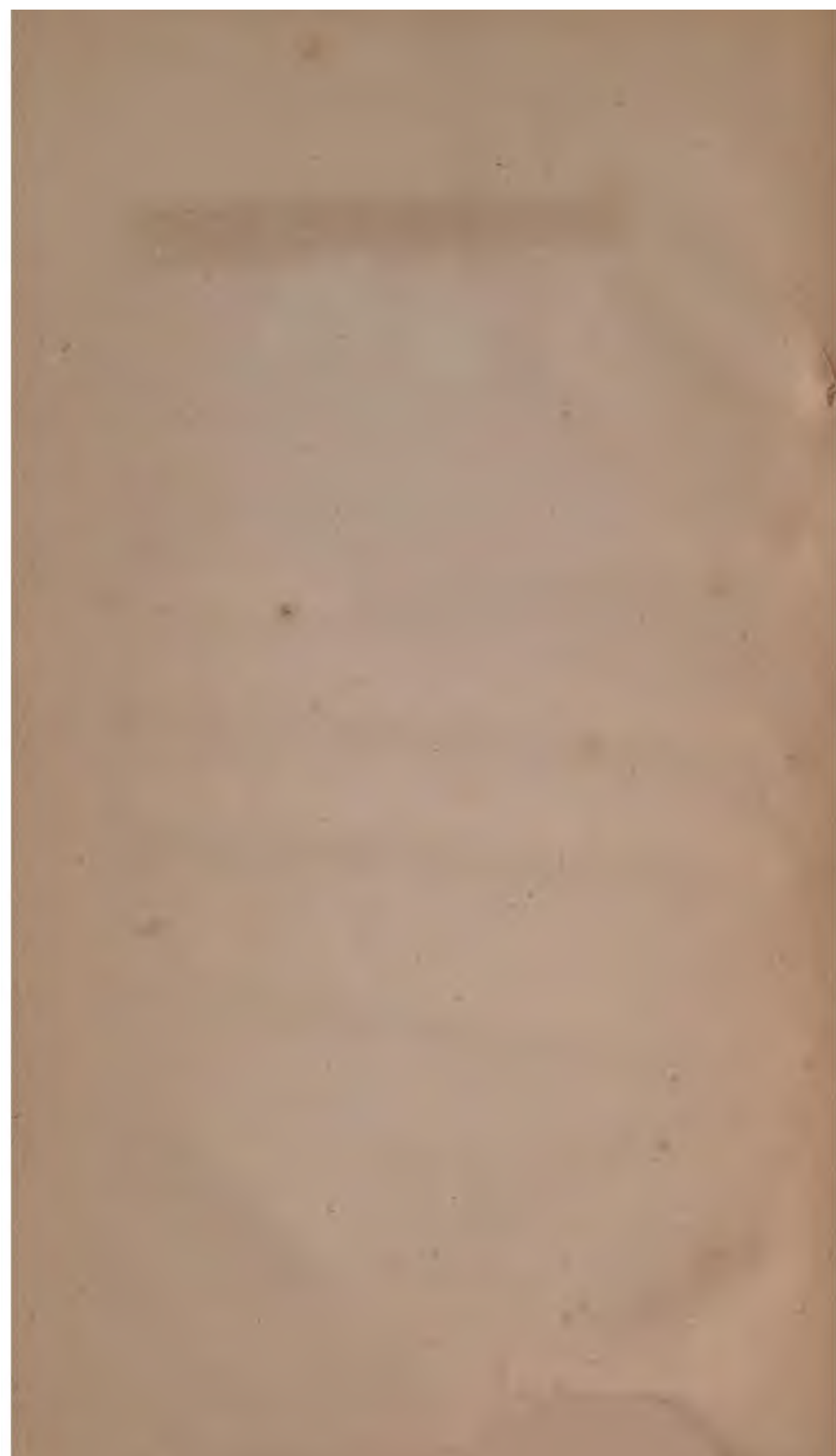
‘But will the revenue, to be derived from the work, justify the necessary expenditure upon it? It is *descending* to speak about revenue, after the facts last stated. The importance of the work, as a public and universal protector of property, and even of lives, from destruction, would warrant a general taxation to pay for it, without reference to any revenue it might yield. All estimates and thoughts of revenue from the work sink into insignificance, when compared with the immense losses it would save; with the considerations of public health and public safety above presented; and with the blessings to individuals in the daily, nay, hourly, luxuries to be furnished from the thousand of hydrants which would “dot the map” of our city.’

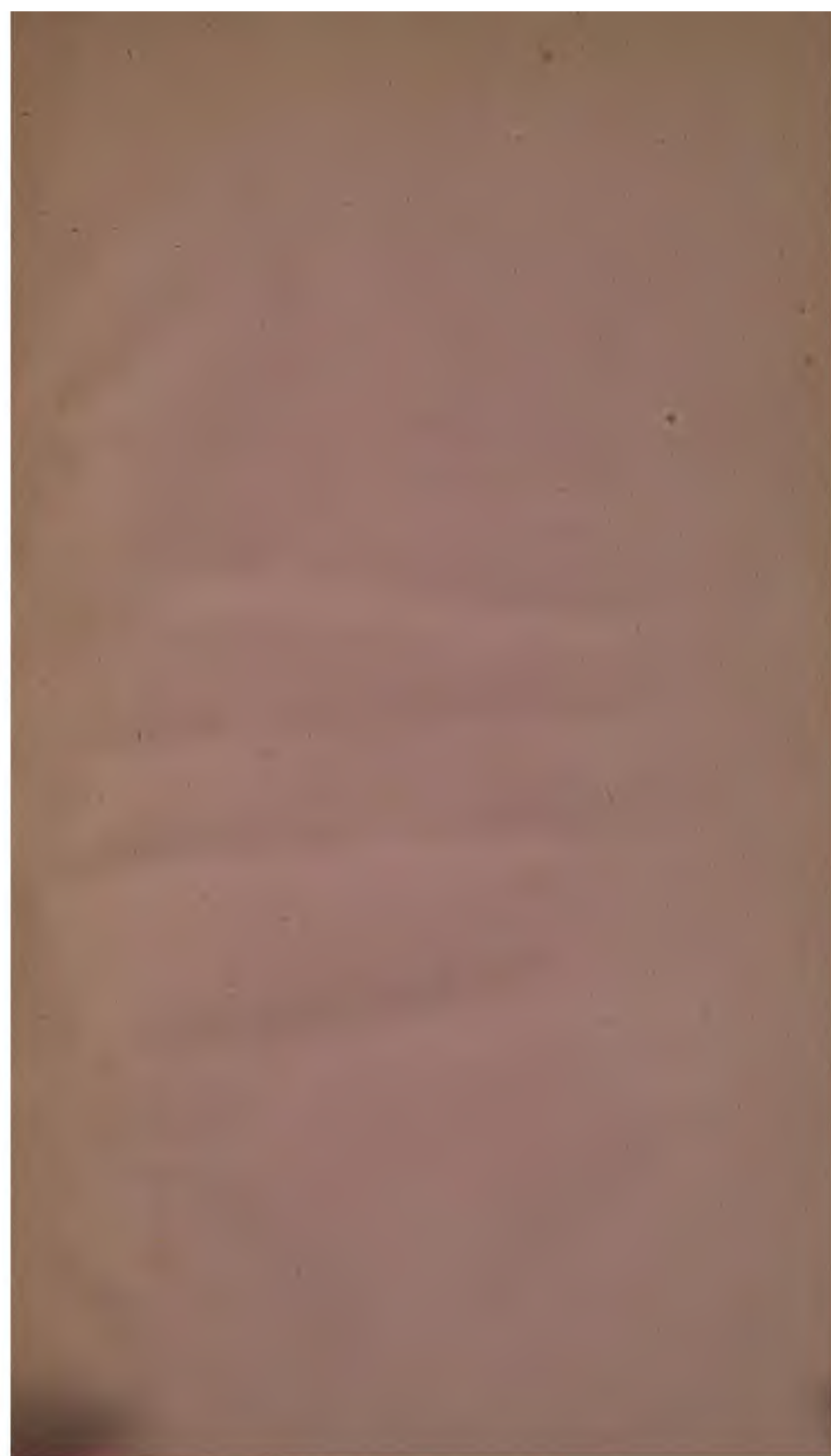
‘The committee humbly trust that the period has now arrived, when the disgrace of her water shall be wiped from this proud city; and, if the last to act, she shall no longer be considered the least in splendor and magnificence of the work by which one of the greatest of human blessings shall be secured to her present and future generations. We are now behind the age. The examples of Philadelphia, and even the small cities on the Hudson, are our reproach. No city in Europe, of half our size, is without its fountains, brought from distant hills or rivers; and even the Turk, performing the rites of his infidel religion, bathes at Constantinople in waters brought from the mountains, at the estimated expense of

FIFTY MILLIONS OF DOLLARS.



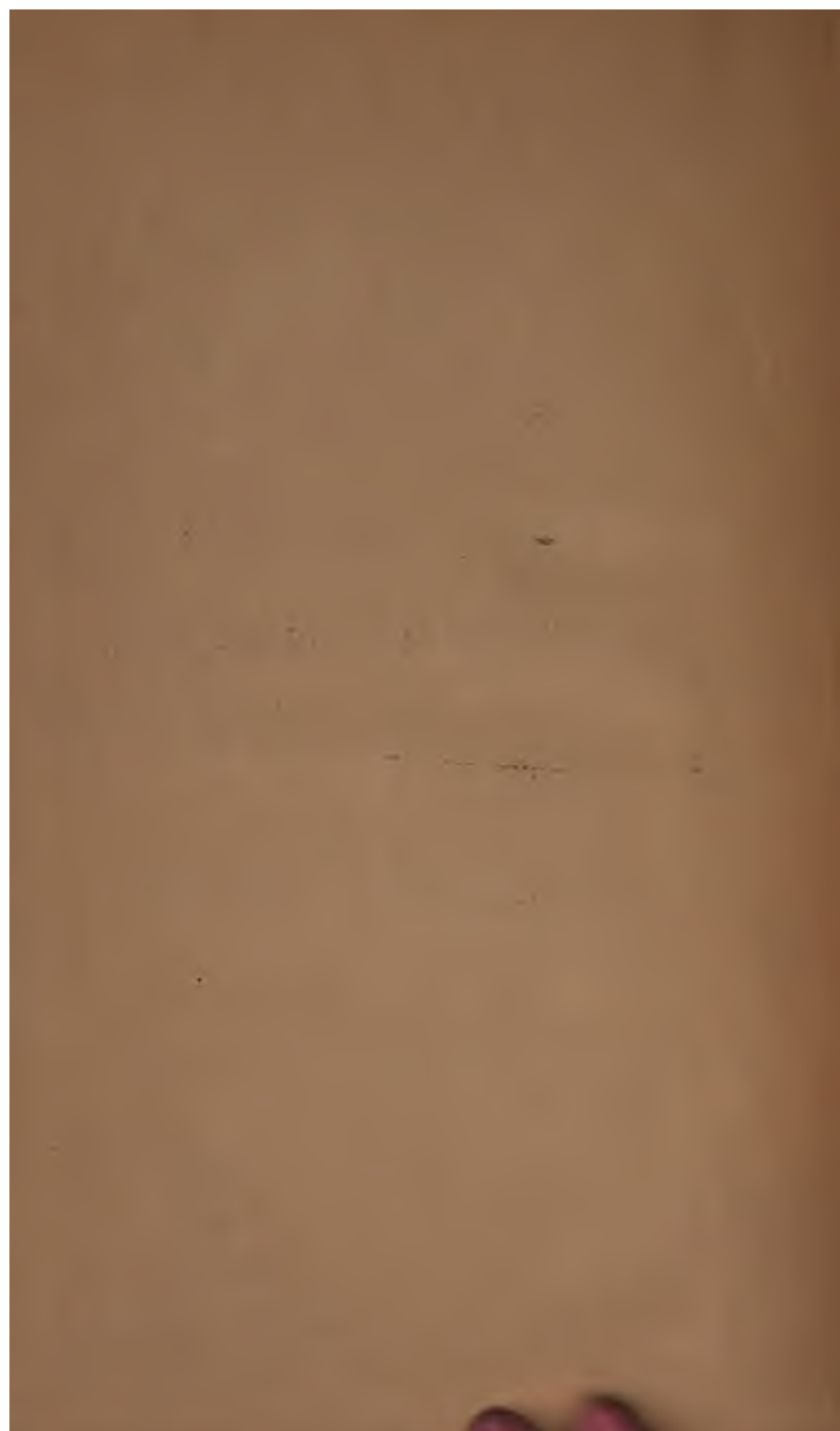












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